Canon

For Beginners

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Canon
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φ55mm

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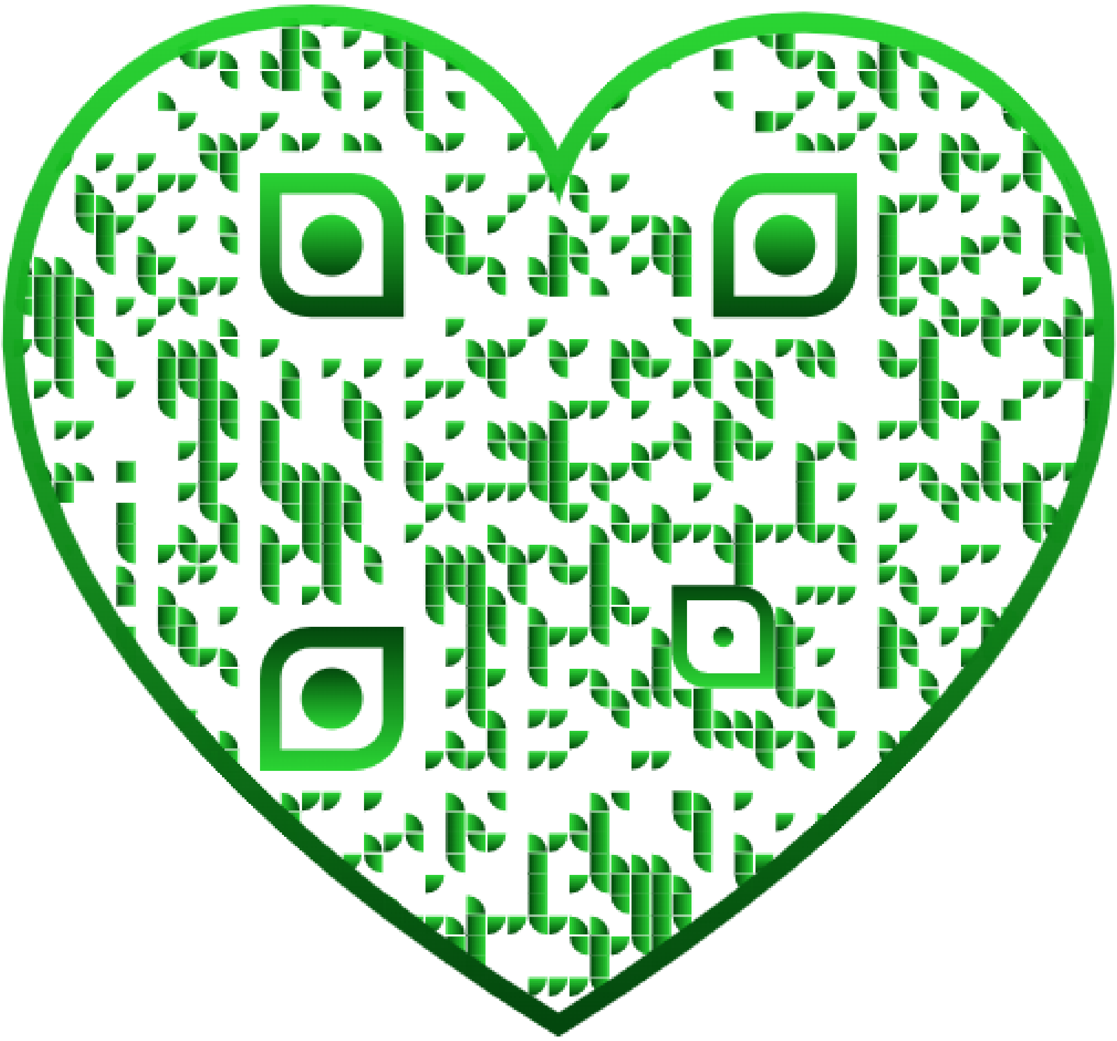

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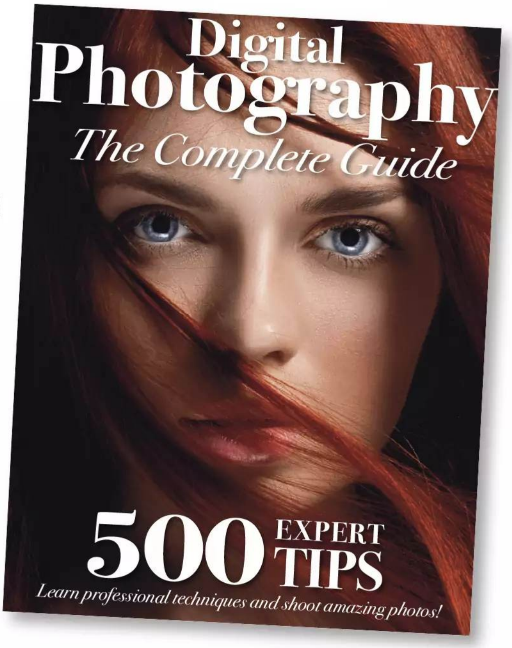
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Canon
For Beginners

Canon For Beginners is the first and only choice if you own a Canon, or are looking to upgrade to one of their amazing cameras, then this is the book for you. We have compiled a concise range of cameras, lenses and accessories to better illustrate what Canon have on offer. Our guides also show you how to master your camera, shoot better photos and enjoy your photography.

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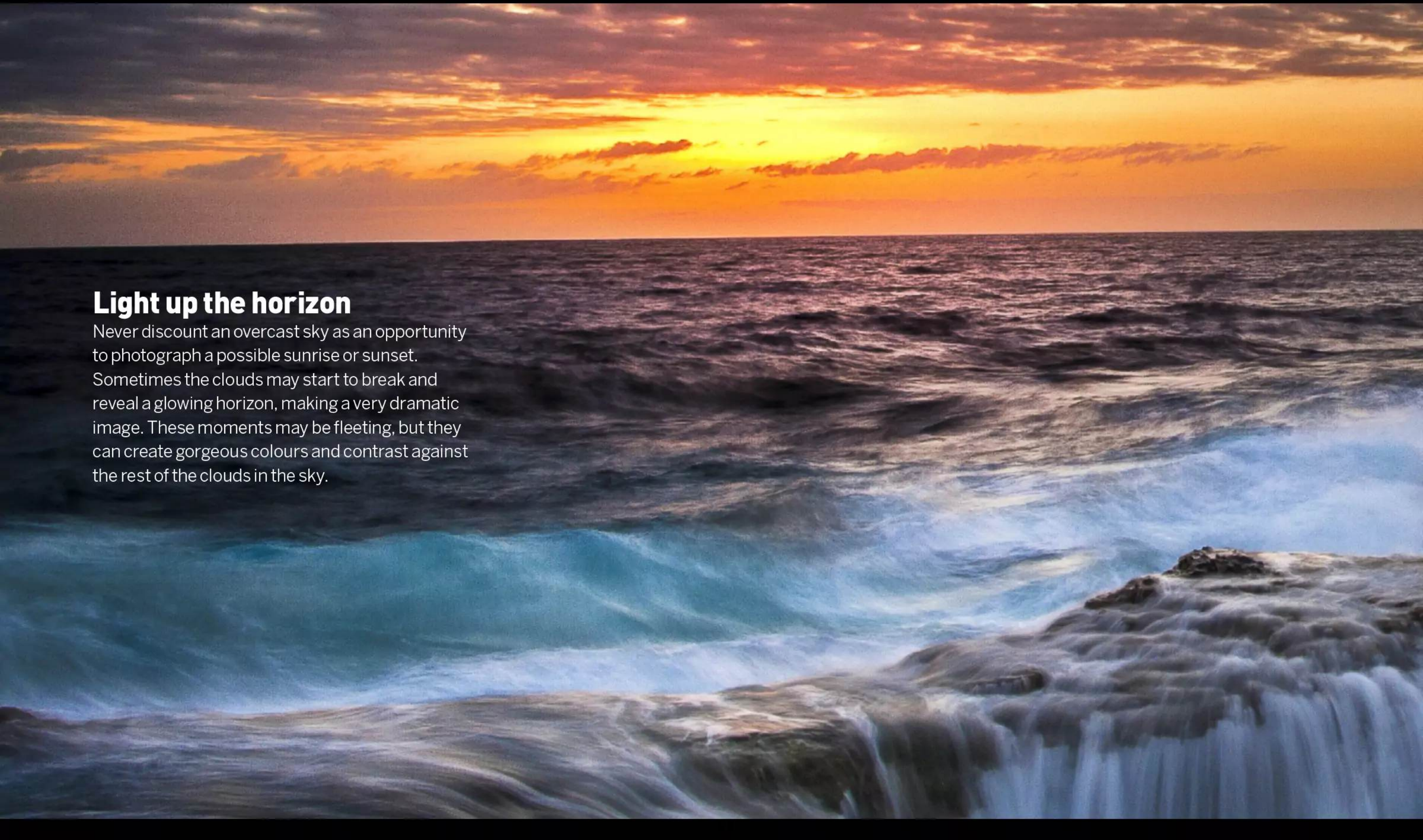
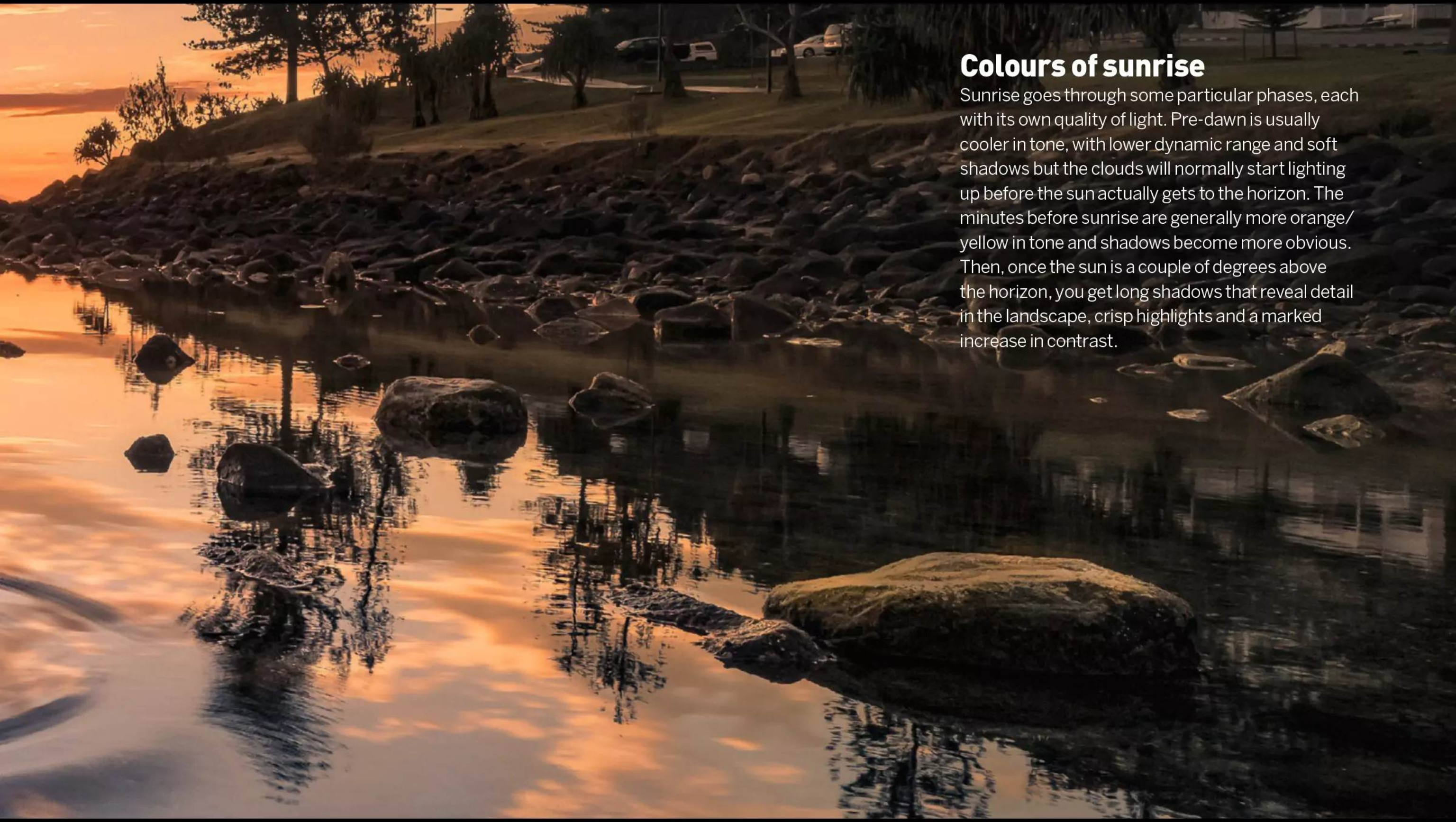


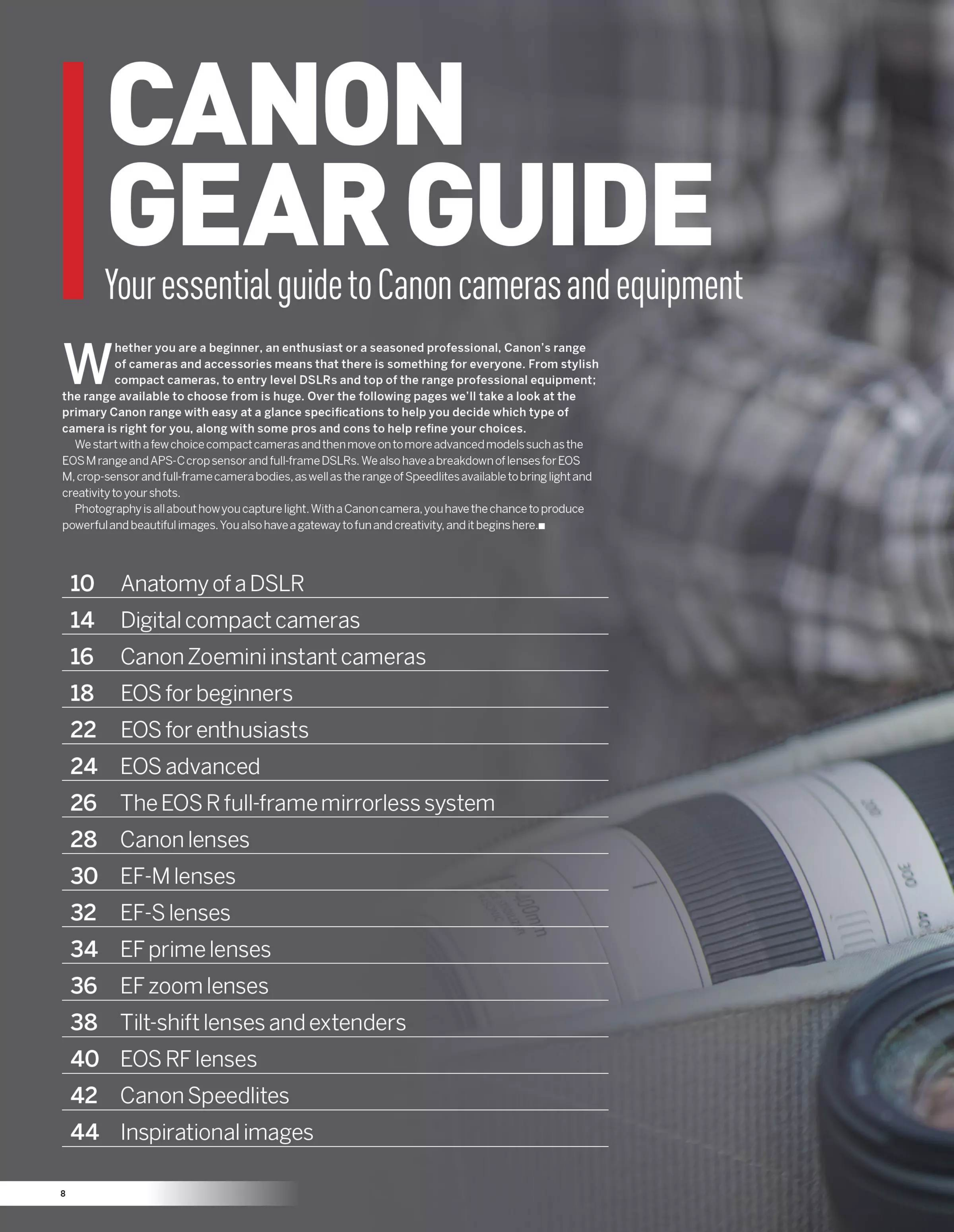
Light up the horizon

Never discount an overcast sky as an opportunity to photograph a possible sunrise or sunset. Sometimes the clouds may start to break and reveal a glowing horizon, making a very dramatic image. These moments may be fleeting, but they can create gorgeous colours and contrast against the rest of the clouds in the sky.



Colours of sunrise

Sunrise goes through some particular phases, each with its own quality of light. Pre-dawn is usually cooler in tone, with lower dynamic range and soft shadows but the clouds will normally start lighting up before the sun actually gets to the horizon. The minutes before sunrise are generally more orange/yellow in tone and shadows become more obvious. Then, once the sun is a couple of degrees above the horizon, you get long shadows that reveal detail in the landscape, crisp highlights and a marked increase in contrast.



CANON GEAR GUIDE

Your essential guide to Canon cameras and equipment

Whether you are a beginner, an enthusiast or a seasoned professional, Canon's range of cameras and accessories means that there is something for everyone. From stylish compact cameras, to entry level DSLRs and top of the range professional equipment; the range available to choose from is huge. Over the following pages we'll take a look at the primary Canon range with easy at a glance specifications to help you decide which type of camera is right for you, along with some pros and cons to help refine your choices.

We start with a few choice compact cameras and then move on to more advanced models such as the EOS M range and APS-C crop sensor and full-frame DSLRs. We also have a breakdown of lenses for EOS M, crop-sensor and full-frame camera bodies, as well as the range of Speedlites available to bring light and creativity to your shots.

Photography is all about how you capture light. With a Canon camera, you have the chance to produce powerful and beautiful images. You also have a gateway to fun and creativity, and it begins here.■

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Anatomy of a DSLR

What goes on at the front of a Canon DSLR?

If you're serious about your photography then sooner or later you're going to want a digital SLR. Despite all the improvements in advanced compact, super-zoom or compact system camera design, in terms of image quality, performance and creative versatility the digital SLR still beats almost every other type of camera hands down. There are some top-end pro cameras costing tens of thousands of pounds which can take better pictures, but frankly if you're considering one of those then you're reading the wrong book.

The acronym "SLR" stands for "single lens reflex". The "single lens" part is to differentiate them from the twin-lens cameras that were popular in the 1960s, while the "reflex" part refers to the reflex mirror, an angled movable mirror that sits in front of the sensor and directs incoming light to the camera's viewfinder. The mirror moves out of the way when a picture is taken, making that distinctive "click-clack" noise.

Only a few years ago digital SLRs were the exclusive preserve of wealthy enthusiasts and top professionals, but thanks to keen competition between the manufacturers and increasing popularity, the price of entry-level DSLRs has tumbled and it is now possible to buy a good basic digital SLR complete with a standard zoom lens without breaking the bank, and even mid-range models are under £600 body-only.

The very top professional DSLRs such as the Canon EOS-1DX Mark II still cost thousands, but then we've all got to have something to aspire to, haven't we? ■

Canon
EOS
5D
Mark II
CANON EF LENS
24mm 1:1.4 L
φ77mm

The Canon EOS 5D Mk II was one of the most successful DSLR cameras of recent years. See opposite to find out what goes on inside!

1 Reflex mirror

The reflex mirror is what gives the Single-Lens Reflex (SLR) camera its name. Light coming in via the lens is split by this mirror, with most going upwards into the viewfinder, while a smaller proportion is allowed through a central part-silvered area and directed to the autofocus system. The reflex mirror flips up out of the light path when the shutter is triggered, producing that distinctive "click-clack" sound that all SLRs make.

2 Sensor

This is the picture-taking element at the heart of the camera. It consists of a wafer of silicon embedded with millions of tiny photocells that produce electrical charge when exposed to light. The sensor in this Canon EOS 5D Mk II measures 36 x 24mm (the same as a frame of 35mm film) and has 21,100,000 individual photocells.

3 Image processor

The electronic circuitry inside the camera takes the individual charge signals from the photocells on the sensor and converts them into a digital image. Modern advanced processors such as the Canon DIGIC 4 in this EOS 5D Mk II are amazingly fast, and also apply sophisticated noise reduction algorithms.

4 Focusing screen

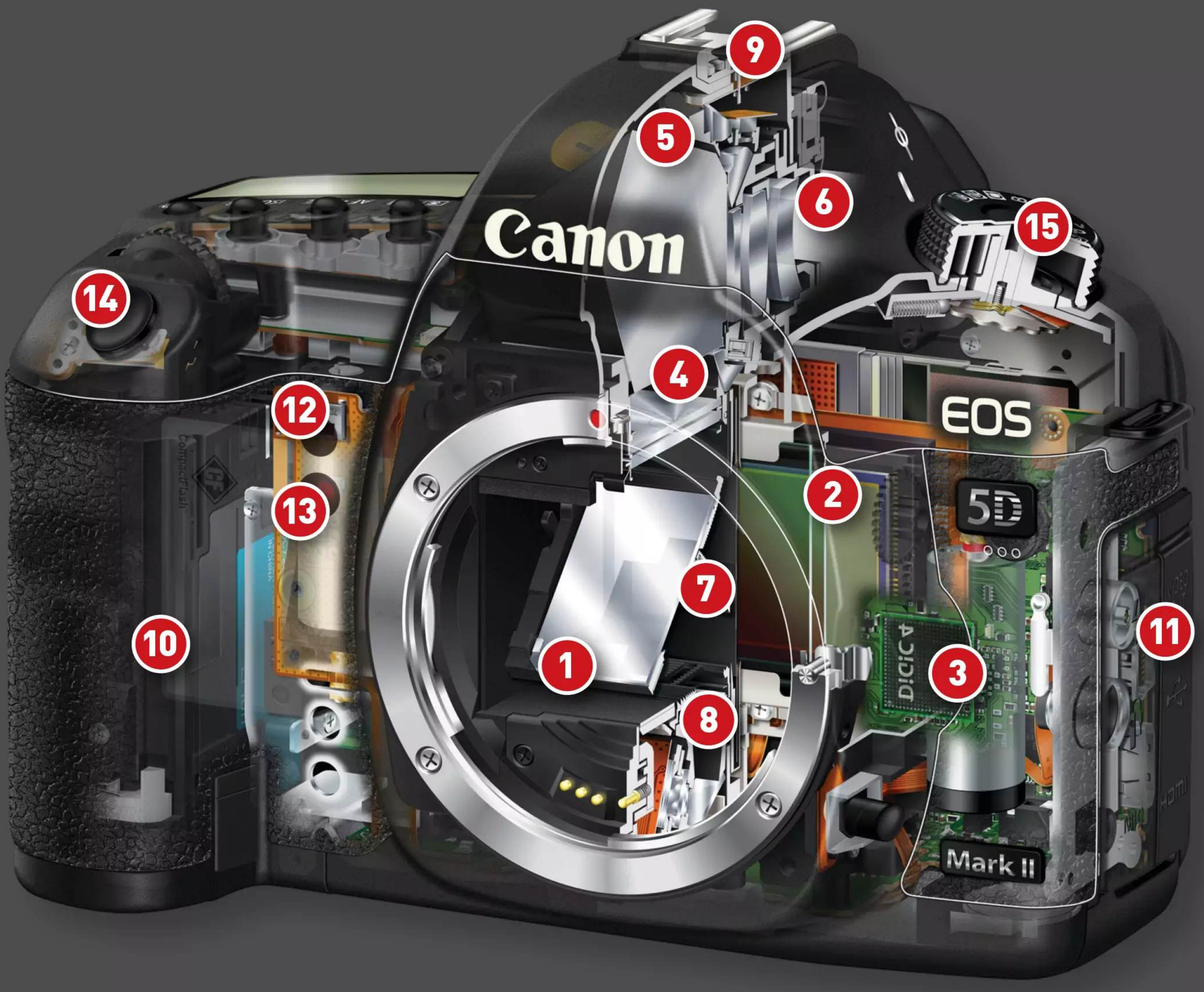
This consists of a ground-glass screen onto which the image seen by the lens is reflected via the reflex mirror. On advanced DSLRs such as this EOS 5D Mk II the focusing screen can be changed for one with grid lines or targeting reticules for specialist applications such as forensic or architectural photography.

5 Pentaprism

This takes the light from the focusing screen and bends it through 90 degrees, directing it into the viewfinder eyepiece. Some cameras have a mirror in this position instead. It is the position of the pentaprism that gives SLRs their distinctive shape.

6 Viewfinder

The defining characteristic of an SLR camera is an optical viewfinder that shows the view through the lens (TTL). Data such as focus points and exposure information are also shown in the viewfinder on a separate LED display. Optical viewfinders are generally considered to be superior to electronic ones.



7 Autofocus mirror

An area in the middle of the reflex mirror is partially transparent, allowing some light through onto a second mirror. This directs some of the incoming light downwards onto the autofocus sensor. This mirror also folds up out of the way when a shot is taken.

8 Autofocus sensor

Some of the light coming in via the lens is directed onto the autofocus sensor. Digital SLRs use a type of autofocus called "phase detection", which is inherently better and faster than the "contrast detection" systems used in compact and super-zoom cameras.

9 Light meter system

Some of the light directed towards the viewfinder is diverted to the light metering system. Modern digital SLRs have sophisticated multi-point light meters that can rapidly analyse a scene and calculate the exposure setting.

10 Battery

Digital SLRs are powered by larger, higher-capacity batteries than most other types of camera. Since the monitor screen isn't in constant use, this gives most DSLRs excellent battery duration, a vital feature if you are using the camera in a professional capacity.

11 Connectivity

Modern cameras have a wide range of connectivity options. This Canon EOS 5D Mk II features USB 2.0 and HDMI as well as a dedicated composite video output connector, all hidden under a weatherproof rubber hatch.

12 IR remote sensor

Most digital SLRs have an optional infra-red remote control for long-range shutter release, much more convenient than the old cable or bulb release gadgets.

13 Self-timer indicator

Even a pro camera like the 5D Mk II can be used for family shots. The LED indicator blinks to mark the countdown for a self-timer shot.

14 Shutter button

Most digital SLRs incorporate a chunky handgrip, usually with the shutter button and adjustment wheel located on the top or front. As with compact cameras a half-press of the shutter button activates the metering and AF systems. DSLR shutters are designed to be used hundreds of thousands of times.

15 External controls

Cameras intended for professional use are built to a more exacting standard, and incorporate weatherproof environmental seals on all the hatches and controls, keeping out dust and moisture.

Anatomy of a DSLR

What goes on at the back of a Canon DSLR?

All DSLRs have a full range of manual functions, and generally have a much wider range of control than even the best super-zooms or advanced compact cameras. DSLR sensors range from 12 megapixels up to over 25 megapixels, and are physically larger than the sensors in compact and bridge cameras, giving them a number of advantages in terms of image quality.

The majority of Canon digital SLRs use a sensor size known as APS-C, roughly half the size of a frame of 35mm film. They are typically around 24 x 16mm, while the advanced professional DSLRs use 'full-frame' sensors. These are the same size as a frame of 35mm film.

All Canon digital SLRs have interchangeable lenses and a wide range of accessories, such as external flashguns, extra battery packs, Wi-Fi transmitters and other gadgets. ■

The Canon EOS 1200D (US Rebel T5, Japan Kiss X70) is an 18mp camera that utilises the APS-C sized sensor with great image quality in an affordable package.

1 Monitor screen

Since DSLRs have optical viewfinders, the monitor screen is used mainly for menu functions and image playback. However most recent digital SLRs do have the option of live monitor view, very useful for shooting at awkward angles when you can't use the viewfinder. Most digital SLR monitors are very large, typically 3.5 inches with a resolution of at least 430,000 dots.

2 Viewfinder eyepiece

The eyepiece is cushioned and protected by a soft rubber frame which can be removed to make room for accessories such as an eyepiece cover or a magnifying finder.

3 Viewfinder optical correction

Most DSLR viewfinders include manual optical adjustment to compensate for long or short-sightedness, so that you can use your camera without needing to wear your glasses.

4 Flash hot-shoe

All digital SLRs have a hot-shoe for mounting an external flashgun. The contacts in the shoe provide a switch to synchronise the flash with the camera's shutter, but more sophisticated flashguns usually from the same brand as the camera can use extra contacts to link up with the camera's exposure metering system, to ensure perfectly exposed flash shots.

5 Pop-up flash

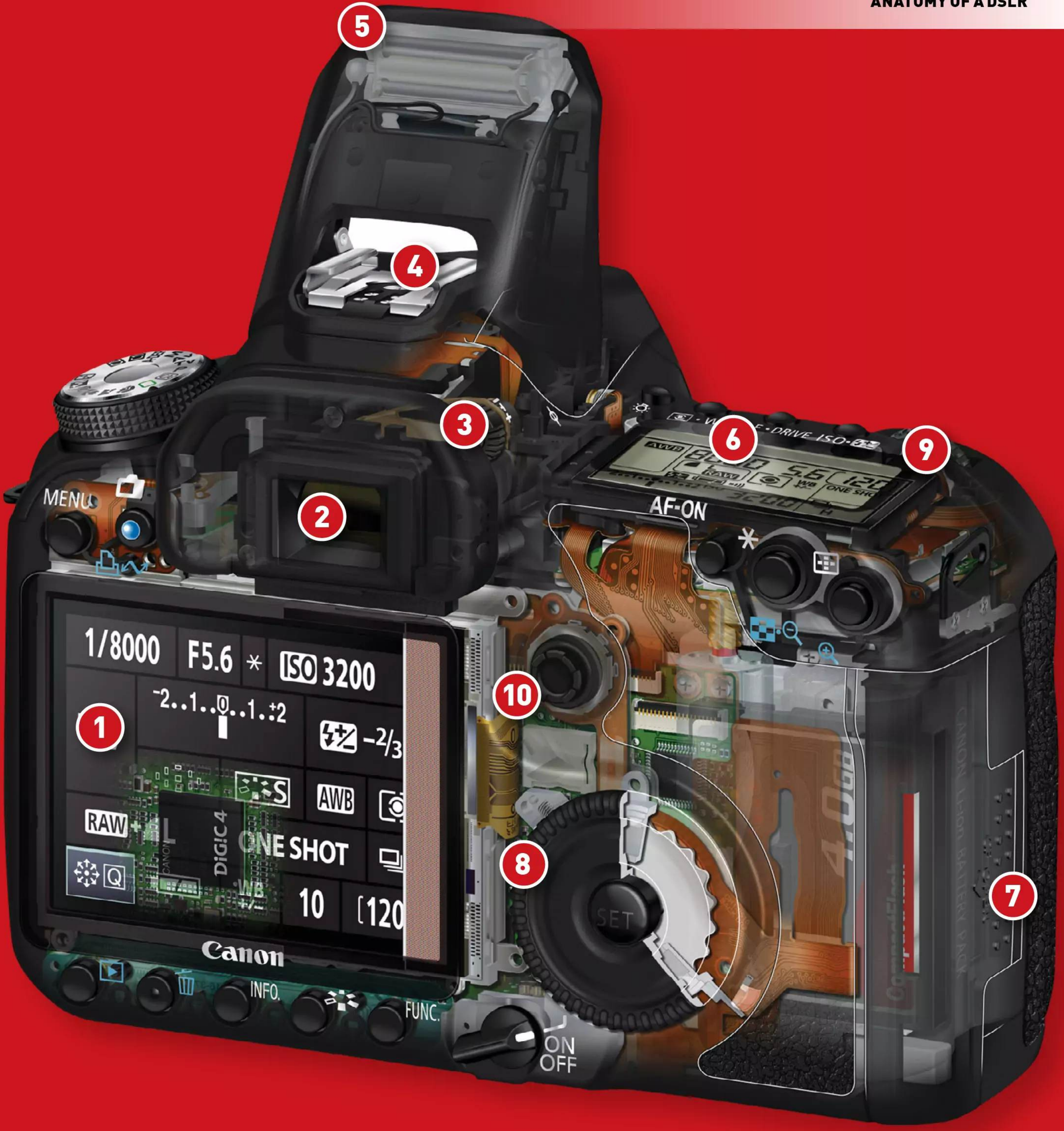
Most entry-level and mid-range digital SLRs have a pop-up flash mounted above the pentaprism. These are usually relatively weak, with a maximum range of only a few metres, and are no substitute for a good external flashgun, but they are useful as a fill-in light for backlit portraits.

6 LCD display

Most top-end DSLR models have a separate LCD data display showing things like exposure information, camera settings, remaining storage capacity and battery duration. They are usually back-lit so you can read them in the dark.

7 Memory card slot

While a few years ago most DSLRs used CompactFlash memory cards, these days the vast majority use SD cards for storage. They are smaller, lighter and cheaper, and in some cases faster too.



8 External controls

Digital SLRs have a much wider range of controls than even advanced compact cameras and the function of many of them can be customised to suit the user. On this Canon EOS 50D mid-range DSLR the exposure is adjusted via this large rear dial and the smaller roller wheel on the top of the handgrip.

9 Adjustment wheel

Most digital SLRs will have one or two of these, usually positioned within easy reach of the right thumb and forefinger. They are used for adjusting exposure values and some numerical exposure settings.

10 Menu control

Most digital SLRs, and particularly the more advanced models, have extensive and comprehensive menu interfaces, with many screens of customisable options and adjustments. Most have a dedicated menu navigation control, either a D-pad or, in the case of this EOS 50D, a small joystick.

Digital compact cameras

The next level of simplicity, shooting and sharing

If you seek something easy to use but still powerful, sleek and stylish, then Canon's range of compact cameras is where you can find your perfect device. Canon's innovative technologies are the backbone of the PowerShot and IXUS range of compact digital cameras that take you to the next level of shooting and sharing beautiful photos and HD quality movies.

From the ultra-compact, to the versatile and affordable, you will no doubt find something that suits your pocket and your lifestyle. Here is just a sample of the digital compact camera range, that will get you inspired and ready to share your precious memories. ■

Canon PowerShot G7 X III

£699/$749/€766

A smart and small, multimedia compact.

- 1.0-type stacked sensor
- 20.1MP effective pixels
- DIGIC 8 image processor
- 4.2X zoom lens
- RAW burst mode 30fps
- Bluetooth & Wi-Fi connectivity
- 4K movie
- 120fps high frame rate movie
- Vertical movie
- 3.0 inch LCD touchscreen

Pros: A nice, responsive touchscreen. Good handling and build quality.
Cons: AF system is a bit outdated. No viewfinder built in. No hot-shoe.

★★½☆☆ 2.5

Canon PowerShot G5 X II

£800/$899/€805

All the power and portability you need in a camera.

- 1.0-type stacked sensor
- 20.1MP effective pixels
- DIGIC 8 image processor
- Superb 5x zoom lens
- Fast f/1.8-2.8 aperture
- Pop-up electronic viewfinder
- 4K movie
- 120fps high frame rate movie
- Bluetooth & Wi-Fi connectivity

Pros: Great overall image quality. Well made. Responsive handling.
Cons: Battery life is sub par. Soft lens wide open. Quite expensive.

★★★★½ 4.5

Canon PowerShot G1 X III

£1149/$1099/€1210

Premium quality and expert control.

- APS-C CMOS sensor
- 24.2MP effective pixels
- DIGIC 7 image processor
- 15-45mm f/2.8 - f/5.6 zoom lens
- 3x optical zoom
- 6x ZoomPlus
- 49-point AF system
- 2,360,000 dot OLED EVF
- 7.5cm vary-angle LCD touchscreen

Pros: Great image quality. Intuitive control layout. Weather sealing.

Cons: No 4K video capability. Battery does not last. Limited lens.

★★★★½ 4.5

Canon PowerShot G3 X

£649/$849/€819

Large sensor camera for great quality images.

- Large 1.0-type sensor
- 20.2 MP CMOS with 3:2 aspect
- f/2.8 - f/5.6 maximum aperture
- DIGIC 6 processor with iSAPS
- 25x optical zoom
- 50x digital zoom
- 31-point AF system
- Full HD 1080p movies
- Quick-bright LCD touchscreen

Pros: Versatile zoom range. Good build quality. Great image quality.

Cons: Could use an electronic viewfinder. Raw performance needs improvement.

★★★★½ 4.5

Canon PowerShot SX740 HS

£399/$399/€3990

Compact travel zoom flagship camera.

- 1/2.3 back-illuminated CMOS
- 20.3MP effective pixels
- DIGIC 8 image processor
- 4.3-172mm zoom lens
- 40x optical zoom
- 80x ZoomPlus
- f/3.3 - f/6.9 maximum aperture
- 3.5-stop image stabilisation
- 7.5cm 922,000 dot LCD

Pros: Large 40x optical zoom. Accurate autofocus. 4K video capability.

Cons: Not so good in low light. No Raw facility. Screen not touch sensitive.

★★★★☆ 4.0

Canon PowerShot SX620 HS

£192/$249/€199

A great travel companion.

- 20.2 MP back illuminated CMOS
- Great for low-light shots
- DIGIC 4+ processor with iSAPS
- f/3.2 - f/6.6 maximum aperture
- Up to 405 shot battery life
- HD movie recording at 30fps
- 25mm wide angle lens
- 25x optical zoom
- Smartphone remote control

Pros: Built in Wireless. Image stabilisation. High resolution sensor.

Cons: No vari-angle screen. Only 9 AF points. No Raw shooting capability.

★★★★☆ 4.0

Canon PowerShot SX60 HS

£329/$340/€372

Amazing zoom range bridge camera.

- 16.1 MP CMOS sensor
- 65x optical zoom
- 21-1365mm zoom range
- 130x digital zoom
- Maximum aperture f/3.4 - f/6.5
- 3.0 inch vari-angle screen
- Wi-Fi and NFC built in
- Electronic viewfinder
- Full HD 1080p at 60fps

Pros: Great image quality. Intuitive control layout. Weather sealing.

Cons: No 4K video capability. Battery does not last. Limited lens.

★★★★☆ 4.0

Canon PowerShot SX540 HS

£240/$349/€288

Small sensor super zoom camera.

- 1/2.3 type back-illuminated CMOS
- 20.3MP effective pixels
- DIGIC 6 processor with iSAPS
- 4.3-215mm zoom lens
- 50x optical zoom
- 100x ZoomPlus
- 9-point AF system
- GPS via mobile
- ISO sensitivity 80 - 1600

Pros: Good image stabilisation. NFC connectivity. Full HD 60p video.

Cons: No Raw capability. Poor battery life. Low res LCD screen.

★★★★☆ 4.0

Canon Zoemini instant cameras

Fun, fast, on-the-go photography and printing

Canon
INSTANT CAMERA PRINTER
2x3 INCH PHOTO
Zoemini C

If you are a self-confessed selfie addict and love to share photos with your friends and loved ones, then you need something that is stylish, portable, and can give you instant results with the minimum of fuss. For every special moment that needs to be captured, you can have a camera and printer small enough to fit in your pocket and with such a compact system, it has never been easier to shoot and print on the go. Canon offers several options that range from 2-in-1 models with cameras and printers built in, to the option to use a portable printer that connects to your mobile devices for on-the-spot image capture and printing, just when you need it.

You might wonder how it is possible to build a printer into a compact camera and make it small enough to fit in the palm of your hand. It's all made possible by Canon's ZINK Zero Ink) photo paper. ZINK paper is infused with a layer of micro crystals that react when heat is applied by the device. If you've ever had a receipt printed in your local store, it's a colour version of that technology. Let's be honest, it isn't archival quality, but it is a great little toy for creating prints instantly.

There are several flavours of Zoemini devices that you can choose from, depending on your needs. The basic Zoemini is just a printer with a 10 sheet capacity that connects to your smart device via the Canon Mini Print app. Next up is the Zoemini C, which lets you both capture and print from the same device, incorporating a 5MP camera and 2x3" ZINK paper prints. If you need more resolution, you can opt for the Zoemini S with an 8MP camera and 314 x 600dpi prints. It's all you need for snaps on the go. ■

Zoemini S

£149/$159/€169

(US Ivy Cliq+)

Instant capture of treasured memories.

TOP PICK

Canon
INSTANT CAMERA PRINTER + APP
2x3 INCH PHOTO
Zoemini S

- 8MP camera
- Flash and 8 LED fill light
- Auto ISO 100-1600
- ZINK printing technology
- Smartphone ready
- 188g model
- Available in Matt Black, Pearl, White, or Rose Gold
- 314 x 600 dpi resolution
- Bluetooth connectivity
- Remote shutter with Canon Mini Print app
- Micro SD card support
- Selfie mirror and ringlight
- 25 print battery life
- 121 x 80.3 x 21.5mm

Pros: A useful companion app. More powerful flash than Zoemini C.
Cons: Slow to start up. Viewfinder may not be so accurate. No LCD screen.

★★★★☆ 4.0

Zoemini C

£109/$99/€119

(US Ivy Cliq)

A perfect pocket companion.

Canon
INSTANT CAMERA PRINTER
2x3 INCH PHOTO
Zoemini C

- 5MP camera
- Flashlight
- Auto ISO 100-1600
- ZINK printing technology
- Smartphone ready
- 170g model
- Available in Pink, Yellow, Green and Blue
- 314 x 500 dpi resolution
- Bluetooth connectivity
- Remote shutter with Canon Mini Print app
- Micro SD card support
- Selfie mirror and ringlight
- 25 print battery life
- 121 x 78.3 x 23.7mm

Pros: No worries about ink running out. 25 print battery life from one charge.
Cons: Flash ring not as powerful as Zoemini S. Prints can be a bit muddy.

★★★☆☆ 3.0

Zoemini

£80/$99/€111

(US Ivy)

Print it as soon as you shoot it.

Canon
Zoemini
Canon
Zoemini
#smile
#friends
#werule
#bffs
#squadgoals

- 10 sheet capacity
- ZINK printing technology
- 2 x 3" prints
- 160g model
- 314 x 400 dpi resolution
- Bluetooth connectivity
- 50 second print speed
- Borderless printing
- Selfie mirror and ringlight
- 20 print battery life
- 118.3 x 82.3 x 18.7mm
- iOS and Android compatible

Pros: Creative and easy to use app. Decent print speed. Lots of fun filters.
Cons: Battery life. No charge remaining indicator. For smartphones only.

★★★★☆ 4.0

EOS for beginners

New creative photographic opportunities await

Canon
CANON ZOOM LENS EF-M 15-45mm 1:3.5-6.3 IS STM
φ49mm

Take more creative control of your photography with a range of digital cameras for enthusiasts that are as easy to use as you need them to be, with image quality that is sure to impress. Turn snaps and video clips into something far more wonderful: images and footage that you are proud of and want the world to see. Use high-end techniques such as shallow depth of field to create differential focus and draw your viewer's eye to your subject. Make your images distinctive with the use of creative filter effects that can all be done in-camera with the touch of a button.

Take command of your camera with controls that are easy and intuitive. Touchscreen LCDs give you greater access to your camera's functions and shooting modes. You can even focus and take photos with just a tap of the screen. All you favourite moments can be captured with responsive cameras that can rapidly autofocus so you never miss a shot.

You even have an on-screen guide to various features of your camera. The guide provides descriptions of many of the camera functions along with helpful advice on how to use them. Now you can shoot in confidence. ■

Canon EOS M6 II

£899/$994/€1099

Lightweight, but powerful, camera for superb images.

- APS-C sensor
- 32.5MP effective pixels
- 180° tilting touchscreen
- DIGIC 8 image processor
- UHD and Full HD
- 14fps continuous shooting
- Bluetooth & Wi-Fi connectivity
- 5,481 selectable AF positions
- ISO range of 100-25600

Pros: High-resolution 32.5MP sensor. 4K video. Manual/Auto focus switch.
Cons: EF-M range of lenses is limited. EVF is an optional add-on.

★★★★☆ 4.0

Canon EOS M6

£839/$899/€939 with 15-45mm kit lens

The speed and performance of a DSLR.

- 24.2 MP APS-C CMOS sensor
- Up to 9fps continuous shooting
- 3.0 inch vari-angle touchscreen
- Full HD 1080p video recording
- 5-axis video stabilisation
- ISO range 100-25600
- DIGIC 7 image processor
- Dual Pixel CMOS AF
- Good ergonomic design

Pros: A lot of direct manual control. Compact and lightweight. Good autofocus system.
Cons: Build quality needs improving. No electronic viewfinder. No 4K video.

★★★★★ 5.0

Canon EOS M3

£543/$764/€522 with 15-45mm kit lens

A great handling performer.

- 24.2 MP APS-C sensor
- Built-in flash
- ISO range 100-12800
- Wi-Fi and NFC connectivity
- 4.2fps continuous shooting
- 3.5 stop optical image stabilisation
- Hybrid CMOS autofocus
- Powerful DIGIC 6 processing
- 31 AF points

Pros: Good image quality. User friendly touchscreen. Handles well.
Cons: Slow performance. Lens choices limited. Limited dynamic range. No 4K video

★★★★½ 4.5

Canon EOS M200

£499/$549/€560

A smart and small, multimedia compact.

- 24.1MP APS-C CMOS sensor
- DIGIC 8 image processor
- 3.0 inch 1.04m dot 180° tilt touchscreen
- UHD and HD movies
- 720p 120fps video recording
- Dual Pixel CMOS AF
- 143 AF points
- ISO range of 100-25600
- Bluetooth & Wi-Fi connectivity

Pros: Simple to operate. Uses the new DIGIC 8 processor. 4K video.
Cons: A modest upgrade on the M100. No viewfinder. A little basic.

★★½☆☆ 2.5

Canon EOS M5

£999/$1099/€1259 with 15-45mm kit lens

Compact and connected.

- 24.2 MP CMOS sensor
- Full HD 1080p movies at 60fps
- Wi-Fi and NFC connectivity
- In-camera 5-axis digital stabilisation
- 7fps continuous shooting in Raw
- Large electronic viewfinder
- Powerful DIGIC 7 processing
- 49 AF points
- Large, tilt touchscreen

Pros: Excellent electronic viewfinder. Great touchscreen. Good connectivity.
Cons: Expensive. No 4K UHD option. Build quality is lacking.

★★★★☆ 4.0

Canon EOS M50

£490/$629/€545

Versatile mirrorless camera.

- 24.1MP APS-C CMOS sensor
- Powerful DIGIC 8 processing
- EF-M lens mount
- Dual Pixel CMOS AF System
- Maximum 143/99 AF points
- 10fps continuous shooting
- ISO range 100-51200
- Raw shooting
- 4K video shooting

Pros: Excellent image quality. Responsive autofocus. Fully articulating screen.
Cons: Restricted 4K video. Limited choice of EF-M lenses. Clunky control system.

★★★★½ 4.5

Canon EOS M10

£298/$449/€338 with 15-45mm kit lens

DSLR quality in a compact body.

- 18.0 MP APS-C size CMOS sensor
- Hybrid CMOS AF II for fast and smooth focus
- Large, tilt touchscreen for clear viewing
- Powerful DIGIC 6 processing
- Dynamic Image Stabilisation
- 49 AF points
- Built-in flash
- 4.6 fps for approx. 1000 JPEG images
- Creative Assist

Pros: Excellent value for money. Easy to use for beginners. Very good image quality.
Cons: Limited creative features. Body finish quite slippery. EF-M lens range limited as yet.

★★★★⯪ 4.5

Canon EOS M100

£699/$599/€759 with 15-45mm kit lens

Compact and easy to use.

- 24.2 MP APS-C sensor
- Built-in flash
- Built-in Wi-Fi, NFC and Bluetooth
- Dual Pixel CMOS AF
- 3.0-inch tilt-type LCD
- Full HD 60p movie recording
- Powerful DIGIC 7 processing
- Up to 6.1 fps with AF Lock
- ISO of up to 25600

Pros: Very small and compact. Useful 180 degree vari-angle screen.
Cons: No 4K video will put certain users off. Limited capabilities.

★★★★☆ 4.0

Canon EOS 1200D (US Rebel T5, Japan Kiss X70)

£235/$339 (body only)

Embrace every opportunity

- 18 megapixel CMOS
- Great low light shots
- EOS Companion free app
- Choice of AF points for creative framing
- Continuous shooting at 3fps
- Powerful DIGIC processing
- Large bright screen for clear viewing
- Stunning 1080p movies
- Easily create engaging movies

Pros: Very affordable entry level. Good low-light performance. Easy to use for novices.
Cons: Live view AF is slow. Shooting speed is slow. Monitor could be sharper.

★★★★⯪ 4.5

Canon EOS 100D (US Rebel SL1, Japan Kiss X7)

£279/$399 (body only)

A DSLR you'll never want to leave behind

- 18 megapixel CMOS
- Great low light shots
- High speed shooting
- Continuous AF in Movies
- Large bright touchscreen
- Powerful DIGIC processing
- Stunning 1080p movies
- Scene Intelligent Auto
- On camera feature guide

Pros: Excellent handling. Light and compact. Good creative features.
Cons: AF system a bit primitive. Battery life less than rivals. Older model soon to be replaced.

★★★★⯪ 4.5

Canon EOS 200D (US Rebel SL2, Japan Kiss X8)

£579/$549/€594 (body only)

Affordable quality.

TOP PICK

- 24.2 MP APS-C sensor
- 9 AF points
- Full HD movies at 60fps
- 5fps continuous shooting
- ISO range from 100-25600
- Powerful DIGIC 7 processing
- 1040k vari-angle touchscreen
- NFC and Bluetooth connectivity
- 63-zone dual-layer metering

Pros: Excellent touchscreen. Great image quality. User friendly.
Cons: Only 9 AF points. No 4K video. Relatively expensive.

★★★★★ 5.0

Canon EOS 750D (US rebel T6i - Japan X8i)

£569/$699/€638 (body only)

Assured automatic shooting.

- 24.2MP APS-C CMOS sensor
- 19-point autofocus system
- Hybrid CMOS AF III focus system (live view)
- 7560 pixel RGB + IR metering sensor with skin tone detection
- 3" fully articulating touchscreen LCD
- Wi-Fi with NFC
- 5 fps continuous shooting
- 1080/30p video

Pros: Fast autofocus system. Wi-Fi and NFC connectivity. Accessible controls.
Cons: Image quality could be better. Viewfinder coverage limited. Video mode is mediocre.

★★★★☆ 4.0

Canon EOS 760D (US Rebel T6s - Japan 8000D)

£619/$699/€ 754 (body only)

More creative freedom.

- 24.2MP APS-C CMOS sensor
- Servo AF in live view
- Eye sensor for use with optical viewfinder
- LCD information display on top plate
- Quick control dial on rear
- 5 fps continuous shooting
- 1080/30p video
- Hybrid CMOS AF III focus system (live view)
- 3" fully articulating touchscreen LCD

Pros: Very good value for money. Latest autofocus technology. Folding touchscreen monitor.
Cons: Plastic body, aluminium frame. No weatherproofing. Video mode is mediocre.

★★★★⯪ 4.5

Canon EOS 2000D (US Rebel T7, Japan Kiss X90)

£325/$549/€399 (body only)

An easy and intuitive first DSLR.

- 24.2MP APS-C sensor
- Optical viewfinder With 9 point AF
- Image stabilisation
- 7.5cm 920,000 dot LCD monitor
- Built-in flash
- 3fps continuous shooting
- DIGIC 4+ image processor
- Full HD video capture
- ISO range 100-6400

Pros: High resolution sensor. User friendly. Built-in Wi-Fi
Cons: No vari-angle screen. No 4K video capture. Only 3fps continuous shooting.

★★★★☆ 4.0

Canon EOS 4000D (US Rebel T100)

£249/$329 (body only)

Affordable DSLR photography.

- 18MP APS-C sensor
- Optical viewfinder With 9 point AF
- 6.8cm 230,000 dot LCD monitor
- Built-in flash
- 3fps continuous shooting
- DIGIC 4+ image processor
- Full HD video capture
- Creative filters
- ISO range 100-12800

Pros: High resolution sensor. User friendly. Built-in Wi-Fi
Cons: No vari-angle screen. No 4K video capture. Only 3fps continuous shooting.

★★★★☆ 4.0

Canon EOS 250D (US Rebel SL3, Japan Kiss X10)

£529/$549/€556

The world's lightest DSLR.

- 24.1MP APS-C sensor
- 4K movies at 25fps
- 5fps continuous shooting
- +/-5 EV exposure compensation
- ISO range from 100-51200
- DIGIC 8 processing
- 1040k vari-angle touchscreen
- Wi-Fi and Bluetooth connectivity
- 63-zone dual layer metering

Pros: Extremely lightweight construction. Great price. 4K video.
Cons: Viewfinder coverage poor. Only 9 AF points. Cropped video.

★★★★⯪ 4.5

Canon EOS 1300D (US Rebel T6, Japan Kiss X80)

£289/$318/€299 (body only)

High quality images.

- 18 MP APS-C sensor
- Full HD movies
- DIGIC 4+ image processor
- 9 AF points
- ISO 100-6400
- 3fps continuous shooting
- Bright 3.0 inch LCD
- Built-in NFC and Wi-Fi
- 95% viewfinder coverage

Pros: Great value. Built-in Bluetooth and Wi-Fi. Good beginner's camera.
Cons: No touch sensitive screen. Continuous shooting rate is low.

★★★⯪☆ 3.5

Canon EOS 800D (US Rebel T7i, Japan Kiss X9i)

£769/$749/€759 (body only)

A next generation DSLR.

- 24.2 MP APS-C CMOS sensor
- 3.0 inch vari-angle touchscreen
- Dual Pixel CMOS AF
- Full HD video recording at 60fps
- ISO range 100-25600
- ISO expandable to 51200
- Built-in Wi-Fi Bluetooth and NFC
- Powerful DIGIC 7 processing
- 6fps continuous shooting

Pros: Excellent image quality. Rapid AF performance. Easy to use.
Cons: Build quality feels cheap. More cost effective options available.

★★★★★ 5.0

EOS for enthusiasts

Develop new skills with a state-of-the-art DSLR

Now you can enjoy ultimate image quality from APS-C and full-frame high-performance sensors. Delve deeper into the fascinating world of photography, try out new ideas and tackle new projects. You have world leading imaging technology at your fingertips, so it's time to raise your game and shoot like you never thought possible before. The EOS system really helps you as you explore new compositions, locations and effects. Whether APS-C or moving up to full-frame, you can enjoy amazing levels of performance and image quality. You can shoot with ambient low light thanks to high ISO capability; or track and capture the action with faster and more accurate autofocus precision.

Thanks to HD video capture built in to your EOS camera, you can be just as creative with your movies as you are with your photos. If you can imagine it, you can capture it too. Your photos and movies will go to the next level and you will find yourself enjoying the process like never before. The camera's built in technology is there to assist whenever you need it. It even boasts transparent LCD overlays on the viewfinder to impart important information that gives you the guidance you need to improve your skills. A Canon DSLR is waiting for you, but which one? ■

Canon
EOS
90D
CANON ZOOM LENS EF-S 18-135mm 1:3.5-5.6 IS USM
φ67mm

Canon EOS 60Da

£699/$1466/€953 (body only)

For astrophotographers.

- More sensitivity to IR light.
- 18-megapixel APS-C CMOS sensor
- Vari-angle 7.7cm (3.0") 3:2 Clear View LCD screen
- ISO 100-6400, expandable to ISO 12,800
- Time-lapse shooting with EOS Utility software or optional TC-80N3

Pros: Dedicated astronomy camera. Good utility software. Excellent IR sensitivity.
Cons: Older autofocus system. Quite expensive. Only really useful for astrophotography.

★★★☆☆ 3.0

Canon EOS 80D

£948/$1199/€1065 (body only)

Fast, powerful and versatile.

- 24.2 MP APS-C CMOS sensor
- 7fps continuous shooting
- DIGIC 6 image processor
- ISO 100-16000 expandable to 25600
- Built-in intervalometer
- Full HD 1080p movies at 60fps
- NFC and Wi-Fi connectivity
- 3.0 inch vari-angle touchscreen
- 45 AF points

Pros: Good image quality. Rapid and accurate AF system. Great touchscreen.
Cons: Some might find the AF system hard to master. No 4K video.

★★★★★ 5.0

Canon EOS 7D Mark II

£1599/$1699/€2181 (body only)

An exciting DSLR to capture all the action.

- 20.2 MP APS-C CMOS sensor
- 10fps continuous shooting
- 65-point AF system with iTR AF
- Dual Pixel CMOS
- Powerful dual DIGIC 6 processing
- Dual memory cards slots
- RGB and IR metering sensor for accurate exposure metering
- Geotag each photo and movie

Pros: Comfortable handling. Excellent image quality. Latest autofocus technology.
Cons: No 4K video mode. No Wi-Fi connectivity. Very expensive compared to rivals.

★★★★½ 4.5

Canon EOS 90D

£1200/$1349/€1299

Fast performance from a full-featured DSLR.

- 32.5MP APS-C CMOS sensor
- DIGIC 8 image processor
- 3.0 inch 1.04m dot vari-angle screen
- 4K UHD 30P video and HD 120P video
- 45-point all cross-type AF system
- Electronic shutter up to 1/16000th
- Bluetooth & Wi-Fi connectivity
- 5,481 selectable AF positions
- 10fps continuous shooting rate

Pros: Uncropped 4K video. 32.5MP sensor. Good ergonomics. Good battery life.
Cons: Elevated noise apparent at higher ISO levels. Not fully weatherproof.

★★★★½ 4.5

Canon EOS 77D

£829/$849/€854 (body only)

Powerful performance and control.

- 24.2 MP APS-C CMOS sensor
- Fastest Live View AF system
- Dual Pixel CMOS AF
- EOS integrated cleaning system
- 45 cross-type AF points
- ISO range from 100-25600
- 3.0 inch 1040K dot LCD
- 6fps continuous shooting
- Full HD 1080p movies at 60fps

Pros: Good 45 point AF system. Excellent Live view performance. Great image quality.
Cons: No 4K video mode. Only 95% viewfinder coverage. Low burst shooting rate.

★★★★½ 4.5

Canon EOS 6D Mark II

£1680/$1999/€1849 (body only)

The entry into the world of full-frame shooting.

- 26.2 MP full-frame CMOS sensor
- Max ISO 40000 expandable to 102400
- In-camera 5-axis digital stabilisation
- Full HD movies at 60fps
- Max burst rate of 6.5fps
- 3.0 inch vari-angle LCD touchscreen
- 4K time-lapse mode
- 45 AF points
- 4.2fps continuous shooting

Pros: Comfortable handling. Useful connectivity options. Refined touchscreen.
Cons: No 4K video mode. No USB 3.0. Viewfinder coverage slightly limited.

★★★★½ 4.5

EOS advanced

Used the world over from war zones to fashion shoots

When it comes to reliability, performance and the production of creative photography and video, the Canon professional range of camera bodies is the one-stop shop for results that you and your clients will love. Whatever the conditions, Canon's professional DSLR reliable performance will keep you shooting and keep delivering the shots you need. They are weather resistant, keeping dust and moisture at bay and their magnesium-alloy construction provide reliable strength and welcome lightness.

Look at any high-end sporting event or fashion shoot and you will see Canon professional cameras and lenses. Sports shooters love them for their advanced autofocus ability to lock on and track the action, coupled with amazing optics from the range of lenses available; it makes them a formidable image capture system. The full-frame benefits of these cameras is also beloved by portrait photographers who enjoy amazing image quality and prime lenses that offer large maximum apertures to deliver amazing shallow depth of field for creative selective focus effects.

If you demand the highest standards of performance and reliability, these cameras will deliver. It's no wonder they are used the world over and now their video capabilities can even be seen on mainstream TV shows. With the Canon range of advanced DSLRs, revolutionise the way you capture stills and video. ■

Canon EOS 5D Mark III

£1959/$2499/€2672 (body only)

A full-frame DSLR

- 22.3 megapixel full-frame sensor
- 61-point AF
- 6 fps continuous shooting
- ISO 100–25,600 sensitivity
- Full-HD video with manual control
- 14-bit DIGIC 5+ processor
- Weather sealing
- 8.11cm (3.2-inch) 1,040,000-dot screen
- HDR mode

Pros: Great image and video quality. Amazing build quality. Fast all-round performance.

Cons: Expensive to buy. Low resolution compared to rivals. An older model now.

★★★★★ 5.0

Canon EOS 5D Mark IV

£3349/$3299/€3249 (body only)

Explore the world of full-frame shooting.

- 30.4 MP full-frame CMOS sensor
- Dual Pixel Raw image system
- DIGIC 6+ image processing
- 4K UHD video capability at 30fps
- 150,000-pixel metering sensor
- 61 AF points
- 7fps continuous shooting
- ISO range 100-102400
- 3.2 inch 1620000 pixel screen

Pros: Advanced AF. 7fps continuous shooting. Excellent image quality.

Cons: 4K video options limited. ISO range unchanged. Expensive compared to rivals.

★★★★½ 4.5

Canon 5DS

£2998/$3699/€4089 (body only)

Capture extraordinary detail.

- 50.6 MP full-frame CMOS sensor
- Dual DIGIC 6 processors
- EOS Intelligent Tracking and Recognition AF
- 61-point wide-area AF
- Weather sealing
- HDR and multi exposure Imaging
- Full HD movies
- Built-in interval timer
- ISO 50-12800 sensitivity

Pros: Astonishing detail resolution. Tough weatherproof body. Excellent autofocus system.
Cons: Expensive, with comparatively slow performance. Limited ISO range.

★★★★☆ 4.0

Canon EOS-1D C

£5760/$8829/€7857 (body only)

Superb 4K movies and stunning stills.

- 4K movies
- 1080p at 50/60fps
- 18.1 MP full-frame CMOS
- Up to 12fps and 14fps stills
- 61 point AF system
- ISO range 100-25600
- Dual DIGIC 5+ processors
- Clear View II 8.1cm (3.2") LCD
- EF and EF Cine lens compatible

Pros: Professional 4K video mode. Superb still and video image quality. Tough and weatherproof.
Cons: Staggeringly expensive. Designed for professional video. Heavy and bulky.

4.5

Canon EOS-1D X

£4999/$5299/€6819 (body only)

Performance redefined.

- 18.1 MP full frame CMOS sensor
- 14fps High speed mode
- 100-51200 ISO, up to H:204800
- 61 point AF system
- 100,000 pixel RGB AE metering
- Full HD 1080p EOS movie
- Dual "DIGIC 5+" processors
- Clear View II 8.11 cm 1,040k LCD
- Ethernet port

Pros: Exceptional low-light performance. Amazing burst shooting speed. Unbeatable build quality.
Cons: Very expensive. Heavy and bulky to carry around. Complicated control layout.

3.5

Canon 5DS R

£3198/$3899/€4362 (body only)

Amazing sharpness and resolution.

- Low-pass filter cancellation for even sharper images
- 50.6 MP full-frame CMOS sensor
- Dual DIGIC 6 processors
- EOS Intelligent Tracking and Recognition AF
- 61-point wide-area AF
- Weather sealing
- HDR and multi exposure Imaging
- Full HD movies

Pros: Astonishing detail resolution. Tough weatherproof body. Excellent autofocus system.
Cons: 5DSR particularly expensive. Relatively slow performance. Limited ISO range.

4.5

Canon EOS C100

£2500/$2000/€2800

Affordable, quality video production.

- Dual Pixel CMOS AF
- Super 35 24.6mm x 13.8mm sensor
- 4206 x 2340 actual sensor resolution
- 3820 x 2160 effective sensor resolution
- ISO 320 to 80,000
- Canon EF lens mount
- Built-in ND filter
- 2 x SDXC card slots
- 1,560,000 dots electronic viewfinder

Pros: Very ergonomic. Great audio control. Improved dynamic range.
Cons: Has the potential to be even better with some serious firmware updates.

4.5

Canon EOS 1D X Mark II

£4799/$5999/€5232 (body only)

The ultimate in shooting performance.

- 20.2 MP CMOS sensor
- Dual Pixel CMOS AF technology
- 61-point AF system
- AI Servo AF III+ for AF precision and tracking
- Dual DIGIC 6+ processors
- 16fps continuous shooting
- 4K video recording at 60fps
- ISO 100-51200 expandable to 50-409600
- 3.2 inch 1,620K pixel LCD touchscreen

Pros: Amazing advanced AF. 4K record at 60fps. Great control layout for excellent handling.
Cons: Expensive. Touchscreen clunky. Only small resolution increase since the 1D X.

4.5

The EOS R full-frame mirrorless system

A new system that can integrate and complement your existing EOS equipment

Although mirrorless cameras have been with us for a number of years, Canon has taken its innovative and popular EOS system and developed it still further with the brand new EOS R and RP cameras. They've taken all the things you love about the EOS DSLR and built a full-frame mirrorless system around it. You have greater and more varied creative possibilities and even more ways of capturing that decisive moment that will take your photography and your filmmaking to new heights.

The new EOS R lens mount system comes with five new lenses built specifically for this new system that will give you unrivalled clarity and image quality across a range of prime and zoom lens types. Don't worry if you have already invested in other EF and EF-S lenses, Canon has made the new EOS R and RP cameras compatible with their vast range of existing lenses. A lens mount adapter is available that can let you use all your existing favourite lenses with the new EOS R and RP camera bodies. Plus, the current range of Speedlite flashes and accessories are all compatible too.

EOS R incorporates a 30.3MP sensor, fast, accurate focusing and the ability to get perfect focus lock in low light situations. Couple that with a high ISO capability and you have a camera that can shoot in the most demanding situations; and its 8fps continuous shooting speeds mean that you never miss a moment. The latest EOS RP is a smaller and lightweight camera with a 26.2MP sensor that has been designed for both travel and everyday photography.

The EOS R system is the DSLR improved; with a smaller, lighter build alongside the same handling and ergonomics you've come to expect from the popular EOS system. Whether you are a professional photographer, filmmaker, or just an enthusiast, you have a choice of cameras that can comprehensively cover every need. ■

Canon
EOS
R
CANON LENS RF50mm F1.2 L USM

Canon EOS R

£2350/$2230/€2585

Canon's first full-frame mirrorless.

- 30.3MP sensor
- Dual Pixel CMOS AF sensor
- Powerful DIGIC 8 image processor
- RF lens mount
- EF and EF-S lenses via mount adapter
- 8fps continuous shooting
- Wi-Fi and Bluetooth connectivity
- 0.5 inch 3.69M dot OLED EVF
- 8cm 2.1M dot LCD monitor
- 4K video 30fps
- ISO range 50-102400
- -6 EV low light autofocus
- 132.5 x 98.3 x 84.4mm

Pros: Smaller and lighter than standard full-frame DSLRs.
Cons: Brand new system has limited lenses at the moment.

★★★★⯪ 4.5

Canon
35
EOS RP

Canon EOS RP

£1399/$1299/€1429

A compact full-frame mirrorless.

- 26.2MP sensor
- Dual Pixel CMOS AF sensor
- Powerful DIGIC 8 image processor
- RF lens mount
- EF and EF-S lenses via mount adapter
- 4779 selectable AF points
- Wi-Fi and Bluetooth connectivity
- 0.5 inch 3.69M dot OLED EVF
- 7.5cm 1.04M dot vari-angle LCD
- 4K video 25fps
- ISO range 50-102400
- 132.5 x 85 x 70mm

TOP PICK

Pros: Priced well to compete. Lightweight construction. 4K video.
Cons: Battery life below par. Dwarfed by the bigger RF lenses.

★★★★⯪ 4.5

Canon lenses

Team a great camera with a great lens for perfect images

Canon lenses are renowned for their optical abilities and the vast range available. Whether you are teaming an EOS M camera with a portable and lightweight EF-M lens or attaching a super-telephoto lens to one of their latest professional DSLRs, you can be sure there is something to suit everyone's needs.

Lenses have many different functions and abilities that allow you as a photographer to frame, compose and capture exactly what you need for the job in hand. If you want a cheap prime lens, with very shallow depth of field due to its large maximum aperture for some portrait work, then you have some great choices. If you need a more exotic tilt-shift lens for architectural photography, then there is a lens for you too. If sport and wildlife photography is more your game, then there are a number of fixed focal length and zoom lenses that can bring distant action right up close. The range is huge but over the following pages, we bring you our pick of various lenses for you to consider. ■

70
100
135
200
300
LOCK
70-300mm
IMAGE STABILIZER
NANO USM
Canon
Canon
EOS
90D
CANON ZOOM LENS EF-S 18-135mm
STABILIZER
ON OFF
LOCK

EF-M lenses

Compact lightweight lenses designed exclusively for the EOS M-mount cameras

Canon
Canon
CANON ZOOM LENS EF-M 18-150mm 1:3.5-6.3 IS STM
EOS
φ55mm

EF-M 11-22mm f/4-5.6 IS STM

£319/$599/€435

Capture panoramic landscapes with this ultra-wide angle 11-22mm EF-M zoom lens.

Canon
11-22mm

- Ultra-wide 11-22mm EF-M zoom lens
- Compact, retractable lens design
- Smooth, quiet STM focusing in movies
- Dynamic IS for steady movies
- 3-stop optical Image Stabiliser
- High image quality
- 0.15m minimum focusing distance
- Manual focus ring

Pros: Very useful 3 stops of image stabilisation. Small and light. Low distortion.
Cons: Not very fast aperture, even wide open. A little pricey for what it is.

★★★★☆ 4.0

EF-M 15-45mm f3.5-6.3 IS STM

£229/$299/€317

A light, compact and versatile standard zoom lens ideal for everyday photography.

15-45mm
Canon

- Versatile zoom covering wide-angle to short telephoto perspectives
- Offers a 24-72mm equivalent focal length
- Optical design incorporates three aspherical elements controls distortion
- Optical Image Stabiliser incorporated into the lens design
- Capture sharp images even in low light

Pros: Good quality glass, and sharp across all apertures. Lightweight construction.
Cons: The lock button to deploy the zoom can be fiddly. Max aperture not the best.

★★★★☆ 4.0

EF-M 22mm f/2 STM

£154/$92/€209

A compact wide-angle pancake lens ideal for landscapes and everyday snapshots.

- 22mm wide-angle lens
- Easy to carry alongside your EOS M
- Superb low light results with f/2.0 aperture
- Smooth, quiet STM focusing in movies
- Great image quality from aspherical lens elements
- Shoot smooth out of focus backgrounds

Pros: Small, lightweight, and robust. Max aperture great for low light. Crisp images.
Cons: No auto/manual focus switch. Chromatic aberration reported. It hunts in video mode.

★★★★½ 4.5

EF-M 28mm f/3.5 Macro IS STM

£280/$299/€309

A unique macro lens to magnify and illuminate your world of photography.

- World's first lens with a built-in Macro Lite
- Capable of focusing at infinity
- Hybrid IS for steady handheld photography
- One UD lens and two aspherical lenses
- Outstanding image clarity
- Equivalent to 45mm standard lens

Pros: Comes with a built-in macro light for close-up work. Good stabilisation and lightweight.
Cons: Focusing is not as fast and precise as you would like. Wider aperture would have been nice.

★★★★½ 4.5

EF-M 32mm f/1.4 STM

£499/$479/€560

For portraits, candids and compositions with a pleasing natural perspective.

- 51mm equivalent focal length
- f/1.4 maximum aperture
- f/16 minimum aperture
- Super Spectra Lens Coating
- 14 elements in 8 groups
- 7 diaphragm blades
- 46° diagonal angle of view
- Closest focusing distance 0.23m.

Pros: A good quality lens. A very fast and sharp EF-M mount lens, even at f/1.4.
Cons: Quite an expensive lens. Focusing not as fast as its USM cameras. No image stabilisation.

★★★★★ 5.0

EF-M 18-55mm f/3.5-5.6 IS STM

£219/$179/€298

The standard kit lens of the EOS M system. A versatile performer, great for stills and video.

- Versatile 18-55mm zoom lens ideal for everyday use
- Easy to carry alongside your EOS M
- Smooth, quiet STM focusing in movies
- Dynamic IS for smooth movies
- Sharp images with 4-stop Image Stabiliser
- Fast Auto Focus in stills, full time manual override

Pros: Great sharpness for a kit lens. Well constructed. Good everyday zoom lens.
Cons: Not particularly fast glass with f/3.5 variable aperture. Slow performer.

★★★★☆ 4.0

EF-M 18-150mm f/3.5-6.3 IS STM

£399/$499/€433

For landscapes or detail, this lens is ideal for your EOS M camera.

TOP PICK

- Versatile 18-150mm EF-M zoom lens
- 1x UD and 2x precision aspherical elements
- Focus down to 0.25m
- Dynamic IS for steady movies
- 4-stop optical Image Stabiliser
- High image quality
- Weighs just 300g
- Optional 55mm filters

Pros: Lightweight and compact design. Sharp images. Useful close-up mode. 4 stops of IS.
Cons: A little costly compared to others. Zoom action could do with more dampening.

★★★★★ 5.0

EF-M 55-200mm f/4.5-6.3 IS STM

£262/$339/€357

A compact telephoto zoom with image stabilisation that gets you closer to the action.

- Get closer to the action
- Image Stabiliser keeps images sharp
- Compact enough to go anywhere
- Smooth, near-silent STM focusing
- Make quick adjustments with a manual focus ring
- Shoot great quality images with sharp details and rich colour

Pros: A great performer for its size. Useful zoom range. Sharp and effective colour rendition.
Cons: It's not a fast lens with a lack of good bokeh. Plastic build. A bit expensive.

★★★★½ 4.5

EF-S lenses

Get creative with focal lengths from ultra-wide to telephoto with lenses for APS-C sized sensors

EOS 100D
CANON ZOOM LENS EF-S 18-55mm 1:3.5-5.6 IS STM
φ58mm

EF-S 10-18mm f/4.5-5.6 IS STM

£180/$249/€245

A light and compact wide-angle zoom.

- Get more in every shot with this ultra-wide zoom lens
- Easy to carry thanks to a compact design
- Smooth, near-silent AF when shooting movies
- 4-stop Image Stabiliser
- 0.22m close focusing

Pros: Smooth and quiet motor. Amazing 4 stops of image stabilisation. Exceptional image quality.
Cons: It uses a plastic mount, not metal. Can be a bit soft at the widest apertures.

★★★★★ 5.0

EF-S 10-22mm f/3.5-4.5 USM

£499/$649/€534

A small lightweight and ultra-wide-angle lens.

- Super wide angle zoom
- Superb image quality
- Lightweight and compact
- Focusing distance of just 24cm.
- Fast near-silent USM AF
- Super Spectra coatings
- Circular aperture

Pros: Excellent image quality and colour rendition. Lightweight and compact.
Cons: Filters will be visible at the wide end. Faster aperture would have been nice.

★★★★★ 5.0

EF-S 15-85mm f/3.5-5.6 IS USM

£529/$799/€721

A versatile image stabilised zoom lens.

- High performance all-purpose zoom
- 4 stop Image Stabiliser
- Automatic panning and tripod detection
- 0.35m close focusing
- UD and aspherical lenses
- 7-blade aperture
- Optional lens hood

Pros: The focus is fast and accurate. Images are sharp with good contrast. AF is quiet.
Cons: Some softness noted at edges. A little pricey. Disappointing bokeh. Quite heavy.

★★★★⯪ 4.5

EF-S 18-55mm f/3.5-5.6 IS II

£149/$199/€129

Affordable general purpose lens.

- Lightweight, compact design
- Wide-angle to short telephoto range
- Four stop Image Stabiliser
- Aspherical lens elements
- 0.25m close-focusing distance
- Circular aperture diaphragm
- High-speed AF

Pros: Excellent image quality, particularly around f/8. Low distortion. 4 stop stabilisation.
Cons: Can cause fringing in high contrast situations. Manual focus control a bit fiddly.

★★★★⯪ 4.5

EF-S 55-250mm f/4-5.6 IS STM

£157/$199/€213

A powerful zoom, with image stabilisation.

- Get close to distant subjects
- Smooth, quiet STM focusing
- Image Stabiliser reduces blur
- Lightweight, compact design you can take everywhere
- Easy-to-use design that delivers superb image quality

Pros: Great lens at a decent price. Spot on focusing is fast and quiet. Lightweight.
Cons: Focusing on distant objects may be difficult. Max aperture may not be suit all.

★★★★⯪ 4.5

EF-S 18-135mm f/3.5-5.6 IS STM

£295/$499/€401

Ultra-wide-angle lens with superb image quality.

- Versatile 18-135mm zoom range
- Smooth, quiet STM focusing
- Dynamic Image Stabiliser for smooth movie footage
- Fast autofocus with full-time manual override
- Minimum focusing distance of 0.39m

Pros: The focus is fast and accurate. Images are sharp with good contrast. AF is quiet.
Cons: Some softness noted at edges. A little pricey. Disappointing bokeh. Quite heavy.

★★★★⯪ 4.5

EF-S 17-55mm f/2.8 IS USM

£699/$829/€769

A low light lens with constant f/2.8 aperture.

EF-S 17-55
IMAGE STABILIZER
ULTRASONIC
AF MF

- Wide angle zoom for EF-S mount bodies
- f/2.8 aperture throughout zoom range
- 3-stop Image Stabiliser
- Fast, quiet auto focus
- Super Spectra coating
- Circular aperture for pleasing background blur
- Passes distance information to E-TTL II
- Optional lens hood
- Focus right down to 35 cm

Pros: Focussing is fast, accurate and very quiet. Constant f/2.8 aperture. Very sharp.
Cons: Quality control issues raised. Can suffer lens creep when shooting downwards.

4.5

EF-S 17-85mm f/4-5.6 IS USM

£219/$175/€229

An excellent all-purpose lens.

EFS 17-85
IMAGE STABILIZER
ULTRASONIC
AF MF

- Exceptional zoom range for all EF-S mount bodies
- Superb image quality
- Lightweight and compact
- Image Stabiliser with 3 stops compensation
- Fast near-silent USM AF
- Super Spectra coatings
- Circular aperture
- Optional exclusive lens hood

Pros: A fine walkaround lens. Light and relatively compact. Useful zoom range.
Cons: Some reported mechanical problems. Low light focus problematic. Variable aperture.

3.5

EF-S 35mm f/2.8 Macro IS STM

£369/$299/€379

A macro lens that brings its own light.

CANON MACRO LENS EF-S 35mm 1:2.8 IS STM
Canon
MACRO EFS 35mm
IMAGE STABILIZER

- 35mm APS-C lens
- 56mm equivalent focal length
- f/2.8 maximum aperture
- f/32 minimum aperture
- Hybrid image stabiliser
- 10 elements in 6 groups
- 7 diaphragm blades
- 42° diagonal angle of view
- Closest focusing distance 0.13m
- Easy-to-use lighting built-in

Pros: Built-in macro light for extreme close up work. Very low geometric distortion.
Cons: A number of reports speak of autofocus issues and a lack of sharp focus.

3.5

EF-S 18-200mm f/3.5-5.6 IS

£389/$699/€530

A compact but powerful telephoto zoom.

IMAGE STABILIZER
EFS 18-200mm
AF MF
STABILIZER ON OFF

- 11x zoom lens – 18-200mm
- 4 stop Image Stabiliser
- Automatic panning and tripod detection
- Close focusing distance of 0.45m
- Aspherical and UD lens elements
- Super-Spectra lens coatings combat ghosting and flare
- Zoom lock maintains minimum size
- Circular aperture for pleasing background blur

Pros: One lens fits all uses versatility. 11x zoom. 4 stops of image stabilisation.
Cons: Possible yellow colour cast issues reported. Quality and colour can suffer.

4.0

EF-S 24mm f/2.8 STM

£139/$149/€159

A great lens for low light shooting and travel.

Canon
EFS 24mm
AF MF

- Super-slim, pancake design
- Natural, human eye perspective
- Smooth, quiet focusing when shooting movies
- Close focus to 0.16m
- Uses a large/2.8 aperture to shoot in low light
- Lens construction 6 elements in 5 groups
- Optical zoom 0.27x

Pros: Vivid colours, great contrast and sharpness. Handles chromatic aberration well.
Cons: Noticeable barrel distortion. Vignetting can be rather strong at f2.8.

4.0

EF-S 60mm f/2.8 Macro USM

£350/$399/€418

The first true macro lens in the EF-S range.

TOP PICK

CANON MACRO LENS EF-S 60mm 1:2.8 USM
ULTRASONIC
EFS 60mm
AF MF

- 96mm focal length in 35mm format
- Compact and lightweight
- High corner-to-corner resolution, contrast and image quality
- Fast auto focus with nearly silent USM
- Full time manual focus override
- Super Spectra coating
- Macro facility lets you focus right down to 20cm
- Filter Size: 52 mm

Pros: Picture quality is excellent. Apertures from f/2.8 to f/32. Virtually no chromatic aberration.
Cons: Focus breathing can be an issue when changing focus. Blue cast reported.

5.0

EF prime lenses

Some key selections from the wide choice of Canon EF full-frame lenses

EF 14mm f/2.8L II USM

£1889/$2099/€2571

A precision ultra-wide-angle lens.

- L-series construction with dust and moisture sealing
- Aspherical and UD lens elements
- Circular aperture
- Super Spectra coatings
- Rectilinear design
- Filter Size: Gelatine type

Pros: Very low distortion for such a wide lens. Image sharpness second to none.
Cons: The 16-35mm wide-angle zoom could be a cheaper option. It's a very expensive lens.

★★★★★ 5.0

EF 24mm f/1.4L II USM

£1224/$1549/€1666

A fast aperture wide-angle lens for low light.

- Wide 84° angle of view
- Fast f/1.4 aperture
- Aspherical and UD lens elements
- Subwavelength structure coating
- USM motor with full-time manual focus
- Weather and dust seals
- Robust build quality

Pros: Very good low light capability. Very sharp at f/4 and above. Fast focus. Sharp.
Cons: Autofocus can be way off on certain lenses. Pronounced distortion apparent.

★★★★⯪ 4.5

EF 28mm f/2.8 IS USM

£381/$499/€518

A compact and affordable wide-angle lens.

- 45mm equivalent on APS-C sized sensors
- Fast f/2.8 maximum aperture
- Up to four-stop Image Stabiliser
- Ultrasonic autofocus mechanism
- Circular aperture for soft background blur
- Super Spectra coatings reduce flare

Pros: Wide maximum aperture great for low light. Four stops image stabilisation. Very sharp.
Cons: Built to a price with lighter materials. Some distortion may be noticeable at the edges.

★★★★☆ 4.0

EF 35mm f/2 IS USM

£399/$549/€543

A versatile standard f/2 prime lens.

- Up to four stops of image stabilisation
- Fast f/2 maximum aperture
- Ultrasonic AF for quick focusing
- Compact, lightweight design
- Eight-bladed aperture for smooth bokeh
- Moulded glass elements for sharpness
- 0.24m minimum focus distance

Pros: Very good quality and sharpness for a non-L series lens. IS works very effectively.
Cons: Some diffraction may be noticeable at f/5.6. Expensive and heavy. AF can be loud.

★★★★☆ 4.0

EF 35mm F1.4 II USM

£1550/$1799/€2150

An ultra-fast standard prime lens.

- A wide f/1.4 maximum aperture
- A wide-angle view with a natural perspective
- Superb low-light performance and depth of field control
- Fast and virtually silent USM autofocus
- Keep shooting even in tough conditions with L-series build-quality

Pros: Fast autofocus. Very sharp images. Very wide maximum aperture for low light work.
Cons: Certain lenses reported with loose focus rings. Large and heavy. Very expensive.

★★★★⯪ 4.5

EF 40mm f/2.8 STM

£350/$399/€418

This versatile lens is a great travel companion.

- Portable pancake design
- Smooth, quiet STM focusing
- Fast f/2.8 maximum aperture for low-light shooting
- Close focus to 0.3m
- Fast, quiet AF for pin-sharp results
- Great image quality right across the frame

Pros: Very small and lightweight. Tack sharp images. Low chromatic aberration.
Cons: Reports of difficulty mounting the lens or focusing stopping. Focusing can be slow.

★★★★⯪ 4.5

EF 50mm f/1.2L USM

£1000/$1499/€1361

A fast standard prime lens, offering great performance for everyday photography.

- Large f/1.2 aperture
- USM autofocus
- Super Spectra coatings
- Circular aperture for excellent background bokeh
- Provides distance information for the E-TTL II flash system
- Soft case and lens hood
- Filter size: 72 mm

Pros: Razor sharp images at f1.2 and up. Top-notch L series build quality and optics.
Cons: It can sometimes focus erratically and suffer from chromatic aberration.

★★★★½ 4.5

EF 85mm f/1.2L II USM

£1452/$1999/€1976

A professional ultra-fast short telephoto, perfect for low light and creative portraits.

- Extreme f/1.2 maximum aperture
- Fast, quiet autofocus
- Super Spectra coatings
- Circular aperture for smooth background bokeh
- Integration with E-TTL II flash system
- Soft case and lens hood
- Closest focusing distance 0.95m
- Filter diameter 72mm

Pros: Beautiful bokeh wide open. Very sharp, with amazing contrast. Perfect portrait lens.
Cons: Expensive. Can be slow to autofocus. Chromatic aberration can be very pronounced.

★★★★½ 4.5

EF 100mm f/2.8L Macro IS USM

£635/$899/€864

An image stabilised macro telephoto lens ideal for precision close-up photography.

- Canon L-series high performance macro
- 4 stop Hybrid IS
- Life size image reproduction (1:1)
- UD lens element
- Water and dust resistant
- Three position distance limiter
- 9 blade circular aperture for beautiful bokeh
- Ring type USM AF motor
- Optional tripod collar

Pros: A sharp, solid, versatile macro lens. Fast max aperture and well balanced.
Cons: Quality control issues raised. AF reported as slow or even fails to lock.

★★★★½ 4.5

EF 300mm f/2.8L IS II USM

£4799/$6099/€6531

A high performance telephoto lens ideal for all types of sports or action photography.

- 300mm f/2.8 high-performance super-telephoto lens
- Part of Canon's acclaimed L series
- Durable, rugged and lightweight
- 4 stop Image Stabiliser
- Enhanced image quality
- 3 IS modes
- Quiet and fast autofocus
- 16 elements in 12 groups

Pros: Incredible tack sharp images. Perfectly suited to demanding environments.
Cons: As good as it is, you cannot overlook the enormous price tag. For the pros.

★★★★★ 5.0

EF 400mm f/2.8L IS II USM

£7698/$9999/€10477

Ultra-high performance, fast telephoto with image stabilisation and USM focusing.

- 400mm f/2.8 ultra-high-performance super-telephoto lens
- Part of Canon's acclaimed L series
- 4 stop Image Stabiliser
- 3 IS modes
- Durable, rugged design
- Enhanced image quality
- Quiet and fast autofocus
- 16 elements in 12 groups

Pros: Incredible performance and image quality. Sharp even at f/2.8. Highest quality optics.
Cons: Staggering price tag. Reports that it is slow to focus with x2 extenders.

★★★★½ 4.5

EF 600mm f/4L IS II USM

£8895/$11499/€12107

The ultimate high-speed super telephoto lens, used by pro sports photographers.

- Fluorite and UD elements
- Fast f/4 max aperture
- Ring-type USM for fast AF
- 4-stop Image Stabiliser
- Protective fluorine coating
- 4.5m min focus
- 9 blade aperture
- Power focus for video
- Dust and moisture resistant

Pros: Focus is fast and sharp, even with a teleconverter. Lighter than the previous version.
Cons: Stories of the lens handle breaking under the weight of the lens. Very expensive.

★★★★★ 5.0

EF zoom lenses

Enjoy the flexibility to change your framing to match your vision

Canon
EOS-1D
X
Mark II

EF 11-24mm f/4L USM

£2699/$2799/€2549

The best in ultra-wide-angle photography.

- Minimum focusing distance of 11 in./0.28m
- 9 diaphragm blades
- 16 element in 11 groups
- The widest angle rectilinear zoom lens
- Minimal distortion for architecture
- Advanced lens coatings
- Swift, nearly silent AF

Pros: Astonishing scope and quality. Superb sharpness, colour rendition, and contrast.
Cons: Colour fringing reported at 11mm. Sigma's 12-24 might be an alternative. Heavy.

★★★★☆ 4.0

EF 8-15mm f/4L Fisheye USM

£912/$1249/€1241

A versatile fisheye zoom lens.

- Circular or full-frame Fisheye zoom lens
- Part of Canon's acclaimed L series
- Durable and rugged design
- Quiet and fast autofocus
- Full-time manual focusing
- Easier lens cleaning
- 14 elements in 11 groups

Pros: Circular and diagonal fisheye options. Excellent L series build quality.
Cons: Very expensive for a fisheye lens. Lens cap fit is suspect. Ghosting around 15mm.

★★★★½ 4.5

EF 16-35mm f/2.8L III USM

£1899/$1999/€2242

With new optics and amazing sharpness.

- Fast constant f/2.8 aperture
- 16 elements in 11 groups
- 9 diaphragm blades
- Minimum aperture f/22
- Minimum focusing distance 0.28m
- Robust, weather sealed construction
- Advanced ring type USM motor

Pros: Sharper corner to corner than the lens it replaced. Light but sturdy. Versatile.
Cons: Heavy vignetting apparent when wide open. Not a jack-of-all-trades landscape lens.

★★★★½ 4.5

EF 17-40mm f/4L USM

£549/$799/€747

A lightweight and affordable ultra-wide zoom.

- Superb optical performance throughout the zoom range
- Fast autofocus speed
- Highly resistant to dust and moisture
- 28cm minimum focusing distance at all focal lengths
- 12 elements in 9 groups

Pros: Quality L series lens. Incredible image quality and fast focusing. Relatively inexpensive.
Cons: Distortion reported at 17-20mm focal lengths. Copies seem to suffer softness issues.

★★★★½ 4.5

EF 24-70mm f/2.8L II USM

£1499/$1749/€1699

It's the perfect lens for any full-frame camera.

- Nine blade circular aperture
- Manual focus override
- Fast, quiet autofocus
- Sealed against dust and moisture
- 0.38m close focus
- Fast f/2.8 max. aperture
- All new optical design

Pros: Superb, almost perfect optics. Fast, silent, and accurate autofocus. Quality build.
Cons: Vignetting around 50-70mm at f/2.8. No image stabilisation. Expensive.

★★★★☆ 4.0

EF 24-70mm f/4L IS USM

£689/$999/€937

With fixed f/4 aperture and close macro focus.

- Versatile zoom range
- Macro mode for up to 0.7x magnification
- Up to four-stop Image Stabiliser
- Two aspherical and two UD lens elements
- Fast ultrasonic AF
- Sealed against dust and moisture
- Nine-bladed aperture for soft bokeh

Pros: Very sharp, compact, and light. Macro mode can be very useful. Impressive four stop IS.
Cons: Heavy vignetting apparent. Back-focusing issues for some. May need calibration.

★★★★☆ 4.0

EF 24-105mm f/4L IS II USM

£1029/$1099/€1208

One of the great all-rounders. Perfect for landscapes, portraits, sports and more.

- Superb L-series optical performance
- 17 elements in 12 groups
- 4 glass-moulded (GMo) aspherical lenses
- 10-blade circular aperture
- Improved IS system for better handheld performance
- Up to 4 stops of shake reduction
- Improved edge-to-edge results with reduced distortions

Pros: Very versatile lens. Controls vignetting very well. Effective four stop IS.
Cons: May not be worth the upgrade if you have the original. Could have been sharper.

★★★★☆ 4.0

EF 70-200mm f/2.8L IS II USM

£1524/$2099/€2074

A rugged and dependable fast telephoto zoom, with 4-stop image stabilisation.

- High-performance, L-series telephoto zoom lens
- Constant maximum aperture of f/2.8
- Four-stop Image Stabiliser
- Fluorite and UD lens elements
- Improved durability
- 1.2m minimum focussing
- Water and dust resistant
- Ring type USM AF motor

Pros: Very sharp wide open, and even sharper at f/4. Good colour rendition and great contrast.
Cons: Not as sharp at the close focus distance. Now superseded by the IS III USM.

★★★★★ 5.0

EF 70-300mm f/4-5.6 IS II USM

£449/$499/€549

Another great all-rounder perfect for portraits, landscapes, sports and more.

- Get closer to distant subjects
- Compatible with all EOS cameras
- A portable design you can take anywhere
- Weighs just 710g
- Unique Lens Information Display
- Nano USM AF also delivers smooth focus
- 4 stop Image Stabiliser
- Superior image quality and sharpness
- 9 bladed lens diaphragm

Pros: Fast autofocus. Improved image stabilisation. Portable, with good image quality.
Cons: Not fully weather sealed. Lens hood an option. Degraded image quality in highlights.

★★★★☆ 4.0

EF 70-300mm f/4-5.6L IS USM

£899/$1349/€1223

A robust and compact image-stabilised telephoto zoom offering superb image quality.

- High performance telephoto zoom lens
- Part of Canon's acclaimed L series
- 4 stop Image Stabiliser
- Two UD elements
- Highly resistant to dust and water
- 8 blade circular aperture
- Quiet & fast autofocus
- Compatible with a tripod collar

Pros: Sharp as they come, with good contrast. Quick and accurate AF. Nice bokeh.
Cons: Focus is a bit slow. Quite heavy and bulky. Variable aperture. Expensive.

★★★★½ 4.5

Canon EF 70-200mm f/2.8L IS III USM

£2000/$2100/€2499

One of the most versatile lenses available with advanced optics.

- Constant maximum aperture of f/2.8
- 3.5-stop image stabilisation
- 23 elements in 19 groups
- Maximum aperture f/2.8
- Minimum aperture f/32
- 8 rounded diaphragm blades.
- 77mm filter size
- Air Sphere coating
- Water and dust resistant

Pros: Bright constant f/2.8 maximum aperture. Improved image stabilisation. Sharp and fast.
Cons: Very heavy for its size. Reports of softness in low light. The IS II remains good value.

★★★★½ 4.5

EF 100-400mm f/4.5-5.6L IS II USM

£1778/$2049/€1906

You can't go wrong with this high performance super-telephoto zoom.

- Versatile, portable super-telephoto zoom lens
- Superb image quality right across the frame
- 4 stop Image Stabiliser
- Customise the zoom control
- Fast, near silent focusing
- Shoot confidently in tough weather conditions
- Focuses down to 0.98m

Pros: Good sharpness and excellent build quality. Low chromatic aberration, low distortion.
Cons: More expensive than the old 100-400mm. IS can lag a little. Very heavy.

★★★★½ 4.5

Tilt-shift lenses and extenders

Control your perspective or extend your reach with special lenses and adapters

TS-E 17mm f/4L

£1799/$2149/€2699

A specialist wide angle tilt-shift lens for distortion free architectural photography.

- Ultra-wide 17mm tilt and shift lens
- Low distortion and high resolution
- 6.5° tilt and 12mm shift
- Independent tilt or shift rotation
- Aspherical and UD lens elements
- Subwavelength Structure and Super Spectra coatings
- Circular aperture
- 18 elements in 12 groups

Pros: A unique use lens. Great sharpness and overall image quality. Low distortion.
Cons: Filters cannot be used on it. Very expensive. No protection for the front element.

★★★⯪☆ 3.5

TS-E 24mm f/3.5L II

£1579/$1899/€1782

A wide range of movement for expanded possibilities of tilt-shift photography.

- Low distortion and high resolution
- 8.5° tilt and 12mm shift
- Independent tilt and shift movements
- Aspherical and UD lens elements
- Subwavelength Structure and Super Spectra coatings
- Circular aperture
- High precision, large diameter moulded glass aspherical lens element

Pros: Almost no visible distortion. Excellent central sharpness. Flexible perspective control.
Cons: Learning curve to using tilt-shift lenses to best effect. Heavy and expensive.

★★★★☆ 4.0

TS-E 45mm f/2.8

£1199/$1399/€1470

An angle of view similar to a standard 50mm lens for natural looking perspectives.

- 45mm tilt and shift lens
- Natural perspective with image control
- 8° tilt and 11mm shift
- Rear focusing system
- Non-rotating front element
- Sharp images from 0.4m to infinity
- Super Spectra coatings ensure accurate colour balance
- 10 elements in 9 groups

Pros: A sharp lens with a very solid build quality. Focus rotation smooth. Great optics.
Cons: Expensive. Issues with focussing at infinity. Manual focus only. Requires manual exposure.

★★★★☆ 4.0

Canon TS-E 50mm f/2.8L Macro

£2199/$2261/€2469

A specialist L-series prime lens with perspective control.

- Macro ratio 1:2 life size
- 50mm full-frame lens
- f/2.8 maximum aperture
- f/32 minimum aperture
- 12 elements in 9 groups
- 9 diaphragm blades
- 46° diagonal angle of view
- ffl 8.5° Tilt and ffl12mm Shift
- Closest focusing distance 0.273m

Pros: Excellent sharpness. Very low distortion. Low chromatic aberration. No flare.
Cons: A very expensive lens with possible limited use. Bulky and heavy. No full rotation.

★★★★⯪ 4.5

Canon TS-E 90mm f/2.8L Macro

£2199/$2199/€2469

Perspective control for beautiful portraits and product images.

- Macro ratio 1:2 life size
- 90mm full-frame lens
- f/2.8 maximum aperture
- f/45 minimum aperture
- Distance information
- 11 elements in 9 groups
- 9 diaphragm blades
- 27° diagonal angle of view
- Closest focusing distance 0.39m

Pros: Excellent sharpness. Very low distortion. Low chromatic aberration. Quality build.
Cons: An expensive lens with a learning curve to reveal its best potential. Bulky and heavy.

★★★★☆ 4.0

TS-E 90mm f/2.8

£1344/$1399/€1472

Suitable for a variety of subjects, from product photography to architecture.

- 90mm tilt and shift lens
- Telephoto lens with image control
- 8° tilt and 11mm shift
- 58mm filter size
- Non-rotating front element
- Featuring six elements in five groups
- Super Spectra coatings reduce flare and ghosting
- 11 elements in 9 groups

Pros: Very sharp lens for a non-L series product. Can use a filter. Almost zero chromatic aberration.
Cons: Locking knobs are small and fiddly. More degrees of tilt and shift would have been nice.

★★★★⯪ 4.5

Extender EF 1.4x III

£359/$429/€478

Ideal for sports and nature photography. Increase the focal length of lenses by 1.4x.

- Extends the master lens focal length by 1.4x
- Outstanding image quality
- Highly resistant to dust and water
- Improved communication between lens and camera
- Optimised lens coatings
- Compatible with L-Series telephoto and telephoto zoom lenses

Pros: Lovely image quality. Lightweight and portable. Superb build quality. IS lenses still work.
Cons: Expensive compared to others. Limited to certain lenses. Can reduce image contrast.

★★★⯪☆ 3.5

Extender EF 2x III

£389/$499/€489

Like the extender 1.4x version but this can increase the focal length by a factor of 2x.

- Extends the master lens focal length by 2x
- Outstanding image quality
- Highly resistant to dust and water
- Improved communication between lens and camera
- Optimised lens coatings
- Compatible with L-Series telephoto and telephoto zoom lenses

Pros: Highly resistant to dust and water. Extends the focal length by 2x. Improved AF performance.
Cons: It is not compatible with ALL EF lenses. Expensive compared to third party options.

★★★⯪☆ 3.5

EOS RF lenses

Begin your journey into the world of full-frame mirrorless photography

CANON LENS RF24-105mm F4 L IS USM
⌀77mm

Canon RF 35mm f/1.8 IS Macro STM

£520/$499/€584

A versatile high-quality 35mm lens for the EOS R mirrorless system.

CANON LENS RF35mm F1.8 MACRO IS STM
Canon
35

- Maximum aperture of f/1.8
- 5 stops image stabilisation
- 11 elements in 9 groups
- 9 diaphragm blades
- Closest focusing distance 0.17m
- 63° diagonal angle of view

Pros: Fast AF system. Amazing build quality. Great sharpness with sharp corners wide open.
Cons: Not a true 1:1 macro lens. Some vignetting visible. Noisy AF motor. Some distortion visible.

★★★★½ 4.5

Canon RF 50mm f/1.2L USM

£2350/$1550/€2641

Amazing optical clarity and performance for your full-frame photography.

TOP PICK

- Maximum aperture of f/1.2
- 15 elements in 9 groups
- 10 diaphragm blades
- Closest focusing distance 0.4m
- 46° diagonal angle of view
- Distance information

Pros: Superb sharpness, even at widest aperture. Very fast AF. Very low chromatic aberration.
Cons: A large and heavy lens. Very expensive. Some vignetting apparent at widest apertures.

★★★★★ 5.0

Canon RF 24-105mm f/4L USM

£1120/$1800/€1258

A flexible lens for portraits, landscapes and creative film making.

Canon
24-105

- Maximum aperture of f/4
- 18 elements in 14 groups
- 9 diaphragm blades
- Closest focusing distance 0.45m
- 84° - 23° diagonal angle of view
- 5 stop image stabilisation

Pros: Five stops of image stabilisation. Customisable control ring. Impressive sharpness.
Cons: Expensive for an f/4 zoom. Some fringing is apparent. Some barrel and pincushion distortion.

★★★★½ 4.5

Canon RF 85mm f/1.2L USM

£2687/$2699/€2999

An L series prime lens with incredible low light performance.

- Maximum aperture of f/1.2
- Smooth, fast, USM motor
- 13 elements in 9 groups
- 9 diaphragm blades
- Closest focusing distance 0.85m
- 28° diagonal angle of view

Pros: Fast autofocus. Highest build quality and performance. Impressive sharpness across the range.
Cons: Not image stabilised. Very big and heavy on the EOS R. Very expensive lens.

★★★★½ 4.5

Canon RF 28-70mm f/2L USM

£3050/$4800/€3428

An amazing quality f/2 advanced L-series wide-angle zoom lens.

- Maximum aperture of f/2
- Minimum aperture of f/22
- 19 elements in 13 groups
- Closest focusing distance 0.39m
- 75° - 34° diagonal angle of view
- Distance information

Pros: Superb image quality. Extremely versatile all-rounder. Fast aperture. Weather sealed.
Cons: Not image stabilised. Needs a tripod collar. Very big, bulky, and expensive lens.

★★★★½ 4.5

RF 24-240mm f/4-6.3 IS USM

£899/$899/€989

A very versatile 10x zoom for EOS full-frame cameras.

Canon
24-240

- Nano USM AF system
- Maximum aperture f/4 to f/6.3
- Closest focusing distance 50cm
- Image stabilisation
- 21 elements in 15 groups
- 7 diaphragm blades

Pros: Versatile zoom range for travel photography. Weighs only 750g.
Cons: Variable aperture slow around 100mm. Noticeable chromatic aberration.

★★★★½ 4.5

RF 15-35mm f/2.8L IS USM

£2329/$2299/€2629

A useful, large, constant aperture, wide-angle zoom lens.

TOP PICK
Canon
15-35

- Wide-angle zoom lens
- Maximum aperture f/2.8
- Minimum aperture f/22
- 110° to 63° angle of view
- Maximum magnification 0.21x
- Closest focusing distance 28cm
- 16 elements in 12 groups
- 9 diaphragm blades
- Weight 840g

Pros: 5 stops of image stabilisation. Very low distortion. Fast focusing.
Cons: Hugely expensive. Large, bulky lens. Edge sharpness is below par.

★★★★★ 5.0

Mount Adapter EF-EOS R

£99/$99/€129

The standard Mount Adapter EF-EOS R allows EF-S and EF lenses to be used on EOS R cameras.

Canon
MOUNT ADAPTER EF-EOS R

Pros: Works flawlessly for connecting existing EF and EF-S glass. Retains full AF.
Cons: The most basic adapter Canon offers for the EOS R. Lacking in features.

★★★★☆ 4.0

Canon RF 24-70mm f/2.8L IS USM

£2399/$2299/€2700

A high image quality and bright maximum aperture zoom lens.

- Wide-angle to portrait length zoom
- Maximum aperture f/2.8
- Minimum aperture f/22
- 84° to 34° angle of view
- Maximum magnification 0.3x
- Closest focusing distance 21cm
- 21 elements in 15 groups
- 9 diaphragm blades
- Weight 900g

Pros: 5 stops of image stabilisation. Quiet focusing. Very sharp around f/8.
Cons: A big price tag. Edge sharpness is reported as average.

★★★★½ 4.5

Control Ring Mount Adapter EF-EOS R

£179/$199/€199

Control Ring Mount Adapter EF-EOS R offers the same lens mount conversion as Mount Adapter EF-EOS R but also adds a Lens Control Ring.

Pros: Sturdy build quality. Adds programmable control ring function. Good weather sealing.
Cons: Suddenly double the price for one added feature. Control ring fiddly in use.

★★★½☆ 3.5

Drop-in Filter Mount Adapter EF-EOS R

£220/$239/€240

Drop-in Filter Mount Adapter EF-EOS R takes the functionality of Mount Adapter EF-EOS R and adds the ability to use drop-in filters.

Canon
DROP-IN FILTER MOUNT ADAPTER EF-EOS R

Clear Drop-in Filter

A clear filter, for users who have bought the drop-in filter adapter but who do not wish to have any filter effects.

Circular Polariser

A circular polarising filter which boosts colour, contrast and saturation, and controls unwanted reflections.

Variable ND

A neutral density filter controlling exposure in movies and prolonging shutter speeds for a variety of creative movement effects.

Pros: A useful addition when teamed with L series lenses on the EOS R body. Saves on a lot of filters.
Cons: Filter adjustment wheel very sensitive. Does not support RF lenses, only EF lenses.

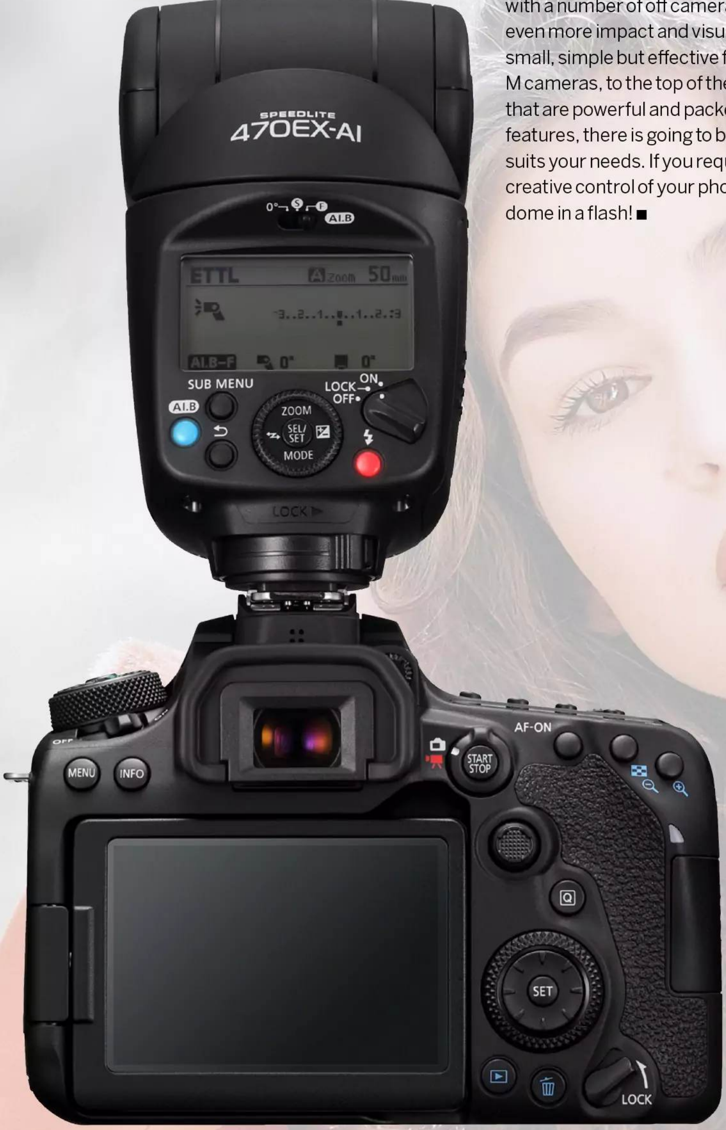
★★★★☆ 4.0

Canon Speedlites

Flashes that will light up your creativity

Bring the light and take a step further in the world of creative photography; as you develop your skills as a photographer, you will discover the benefits of being in control of your own lighting to really express your creative vision. Using your own lighting equipment is how you elevate your work above those who shoot with ambient light. Using your own lighting schemes allows you to produce a distinctive look that cannot be achieved any other way. Whenever you are using a flash to simply fill in dark shadows on a bright day or using a multiple light setup to bring life to a dark setting, the Canon Speedlite range of flashes will give you all the creative control you need.

Use them mounted to the hot-shoe of your camera or use a wireless triggering system with a number of off camera flashes to get even more impact and visual drama. From small, simple but effective flashguns for EOS M cameras, to the top of the range models that are powerful and packed with impressive features, there is going to be something that suits your needs. If you require versatility and creative control of your photography, it can be dome in a flash! ■



Canon Speedlite 600EX II-RT

£537/$499/€629

Powerful top of the range professional Speedlite, packed with advanced features.

- E-TTLII/E-TTL exposure control
- Guide Number of 60 (m, ISO100)
- Transmitter range of 30m outdoors
- Metal hot-shoe foot
- Infrared/radio slave function
- Fast, quiet recycling
- Auto zoom for sensor size
- Bounce and swivel control

Pros: Powerful and versatile flash for creative shooting. Off-camera possibilities are endless.
Cons: Reports of incompatibility with older 600EX models and malfunctions cropping up.

★★★★☆ 4.0

Speedlite Transmitter ST-E3-RT

£239/$263/€325

A wireless flash trigger with 30m range, compatible with many Speedlite flashguns.

- Radio frequency remote flash trigger
- Fire selected Speedlites from 30m away
- Controls up to 15 flashguns
- Remote camera triggering
- Weather sealed against dust and moisture
- Unlike IR transmitters does not need line of sight to operate

Pros: Easy to use and configure. Doesn't need line of sight. Weather sealed.
Cons: No focus assist beam. Does require a post 2012 camera for full functions.

★★★★☆ 4.0

Canon Speedlite 270EX II

£129/$139/€175

A powerful but easy-to-use flashgun. Use it on or off the camera with wireless control.

- Lightweight compact design
- Guide Number 27 (m, ISO100)
- Bounce flash head
- Wireless slave function
- Trigger your EOS camera with Remote Release button
- Variable angle of coverage
- Fast, silent recycling

Pros: A great compromise of power over size and portability. Very cost effective. Lightweight.
Cons: Does not have a test button. Not the most powerful flash around. Cheaper options around.

3.5

Canon Speedlite 320EX

£193/$215/€262

A versatile flash with a built-in LED video light, bounce-tilt head and wireless technology.

- Guide Number 32 (m, ISO100)
- Compact lightweight design
- Bounce-and-swivel flash head, with 24mm and 50mm zoom settings
- Integrated LED video light
- Wireless slave for off-camera TTL flash
- Remote Release button
- Fast, silent recycling

Pros: Includes an LED light for modelling. Very compact, with a decent guide number.
Cons: No focus assist beam. Doesn't support E-TTL metering. Expensive for what it is.

3.5

Speedlite EL-100

£199/$199/€222

Get started with flash and make better looking images easier than ever.

- Guide Number 26 (m, ISO100)
- Auto mode for simple flash shooting
- Bounce flash vertical and horizontal
- Optical sender/receiver for off-camera flash
- Zoom head
- High speed sync
- AF assist beam
- Minimum recycling time 5.8s

Pros: Great little flash to team with a smaller DSLR. Small, light, all-purpose unit.
Cons: Modelling is not supported on EOS R and M models of camera. Power might be lacking.

4.0

Canon Speedlite 430EX III-RT

£219/$249/€265

A powerful and advanced but easy to use on and off camera.

- E-TTLII/E-TTL exposure control
- Guide Number of 43 (m, ISO100)
- 24-105mm zoom head with 14mm wide panel
- Fast and silent recycling
- Metal hot-shoe foot
- 180 degree swivel head
- Infrared/radio slave function
- AF assist beam

Pros: A decently powerful guide number and excellent array of features. Very portable.
Cons: The IR assist only works with the centre AF point. This is a downgrade from the previous model.

4.5

Speedlite 470EX-AI

£454/$349/€499

With a unique motorised bounce head that automatically adjusts to control shadows.

- Guide Number 47 (m, ISO100)
- Clear dot Matrix LCD
- Auto AI bounce function
- 14mm Lens coverage via adaptor
- Auto zoom for sensor size
- Infrared wireless flash
- AF assist beam
- 1-19 AF points supported

Pros: Automatically bounces flash output. Great for beginners. Good max output. Fast recycle.
Cons: It's an expensive option for beginners. No optical, or RF master and slave modes.

4.0

MR-14EX II Macro Ring Lite Flash

£499/$539/€559

Creative macro lighting control from camera or flash.

- E-TTLII/E-TTL exposure control
- Independently variable dual flash tubes for creative lighting control
- LED modelling lamps make composition and focusing easier
- Powerful performance with guide number 14 (ISO 100,m)
- Metal hot-shoe foot

Pros: A well-built and well-designed ring lite flash. Can be used as a portrait flash.
Cons: Does not support RF capabilities. Needs mount adapter. No directional control.

4.5

The majesty of mono

Don't be a fair weather photographer. You don't always need a stunning sunrise or glorious sunny day to undertake a photography session. Sometimes, a grey day can give up the goods as well as any sunny day. It's just a case of approaching it from a different angle. If it is a lacklustre day, the shadows will be flat or non-existent and there will be very little contrast compared to a bright day. Make the most of form and texture instead. Also, perhaps you could shoot with the intent of doing a mono conversion such as the examples seen here.

UNDERSTAND YOUR CAMERA

Our guide to some photographic essentials

Modern Canon cameras are marvels of miniaturised technology, with many automatic functions to help you take good photos in a wide range of different situations. However by learning more about how your camera works and how to use its many features you can expand the scope of your photography and get good results every time, even in difficult conditions. For owners of more advanced DSLRs there are options such as aperture and shutter speed control, sensitivity and white balance, as well as creative light metering modes and manual focusing, all of which can be used creatively to make your photos really stand out.

Photography is a rewarding and potentially profitable hobby, and the more you learn about it the more you'll get out of it. Read on and find out a bit more about how that expensive gadget you bought actually works and some of the main principles behind photography. ■

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Canon
Canon
CANON ZOOM LENS 5x IS
G1X

Shooting modes

Getting in the right mode for the right situation

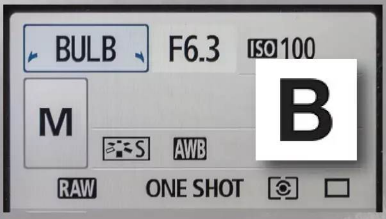
All but the most basic budget compact cameras have a selection of shooting modes, usually chosen by a dial on the top or back of the camera. Easy-to-use, mainly automatic cameras in the range will only have a few shooting modes, while the more sophisticated cameras such as the EOS DSLRs may have as many as a dozen, including manual exposure options and user-programmable special settings.

As newer models appear in the range or older models are updated, the shooting modes available will be revised and possibly expanded. Shown on this spread are some of the most often used modes selected from the mode dial on the top of the camera. ■

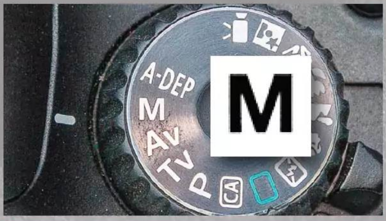
Auto DOF Mode: As you focus on your subject, the camera will use the other focus points to measure the distance of the other objects in the viewfinder. It will determine what the appropriate aperture setting should be to render everything in focus.

A-DEP
M
Av
Tv
P
CA

Bulb Mode: Lets you control both shutter speed and lens aperture independently. Instead of a fixed shutter speed, many cameras in the range offer a Bulb shutter, allowing long exposures for as long as you hold the Shutter button down.



Manual Exposure: This mode provides the same range of exposure control as the other shooting modes, but lets you control both shutter speed and lens aperture independently for more creative control.



Aperture-Priority AE: This allows you to set the lens aperture, while the camera is left to select the most appropriate shutter speed. You have control over all the other exposure variables, including the control of exposure compensation.

Shutter-Priority AE: You can manually set the shutter speed you want to work with, while the camera chooses the best corresponding aperture setting. You have control over all other exposure variables, including exposure compensation.

Creative Auto Mode: When set to CA mode, the camera allows the user to adjust picture style, motor drive, and exposure compensation, as well as to use the program shift function.

Program AE: Similar to the Full Automatic mode, but allows more control over the exposure variables. Aperture and shutter speed are automatically selected by the camera, but you can alter exposure to different apertures by turning the Main dial.

Full Automatic Mode: Full Automatic is indicated on the Mode dial by a green rectangular outline. In this mode, the camera makes all exposure decisions with the exception of image quality. Autofocus mode is set to AI Focus.

Flash Off Mode: Flash Off mode disables both the internal flash head and any external flash unit connected. Focus is set to AI Focus mode, the AF assist lamp disabled. ISO and white balance are set automatically as well.

Portrait Mode: This mode uses a large aperture setting to decrease the depth of field, which blurs the background to emphasize the subject. ISO and white balance are set to Auto.

Landscape Mode: Landscape mode combines slower shutter speeds with smaller aperture settings to increase the depth of field when shooting broad panoramas and sweeping landscapes.

Close-up Mode (Macro Mode): Turning the Mode dial to the macro flower symbol sets the camera for capturing smaller subjects such as flowers, jewellery, and other small details. The autofocus mode is automatically adjusted to One Shot.

Sports Mode: This mode uses a faster shutter speed to capture fast-moving subjects. The autofocus mode is automatically set to AI Servo to predictively track your subject and keep it in focus as it moves.

Night Portrait Mode: This mode is for taking pictures of people at sunset or at night, letting the flash illuminate the subject, while the longer exposure provides a brighter view of the surroundings.

Movie Mode: When Movie mode is selected, the camera's mirror and shutter open, as in Live View mode, but the Live View / Movie button on the camera's back functions as the start/stop button for movie recording.

Focusing

Getting the best out of your autofocus system

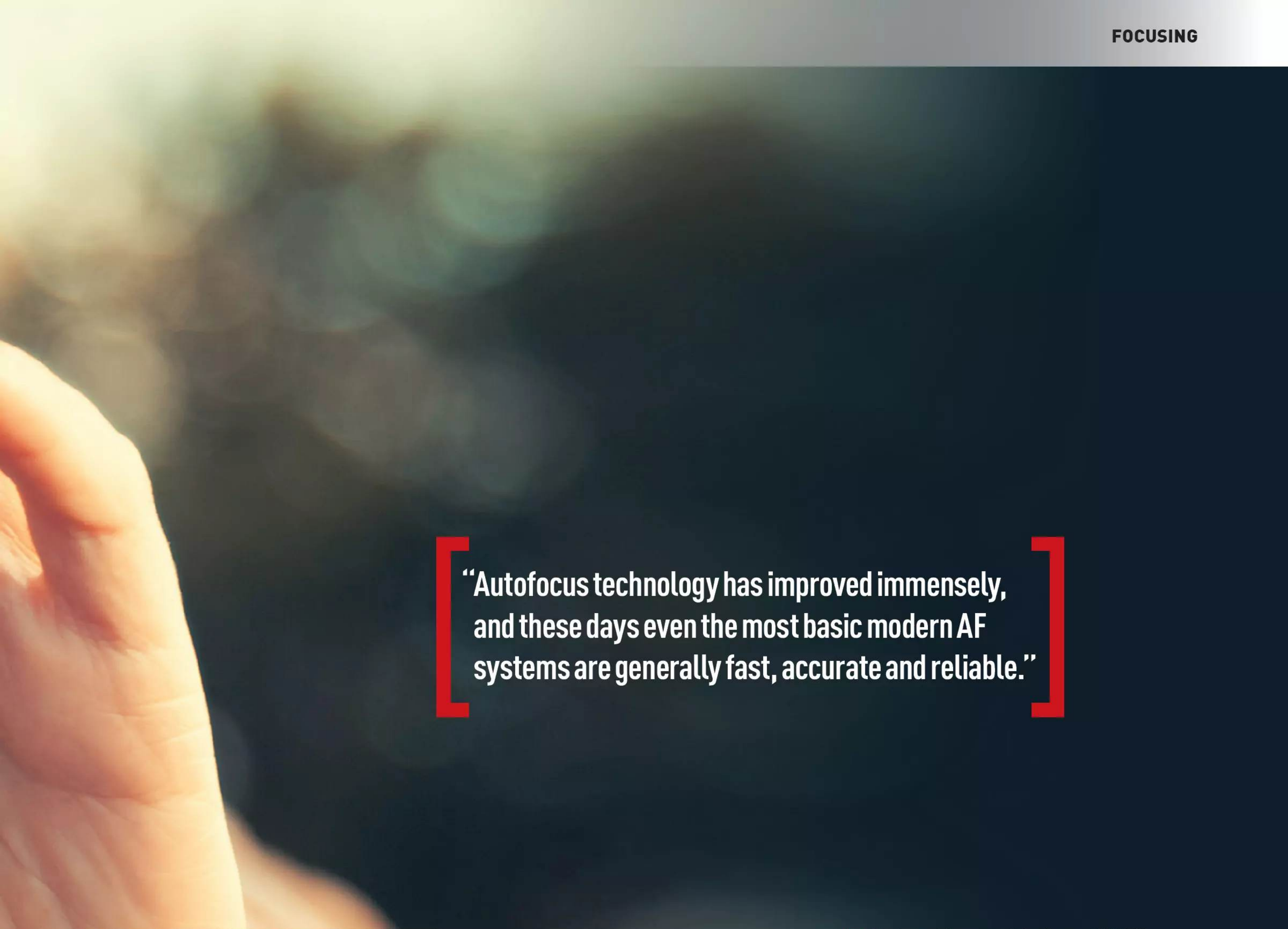
Autofocus is so easy to use that the focus switch on some of your lenses may never have been moved to the manual position. Most of the time autofocusing gives excellent results. It is faster than manual focusing, and often more accurate. However, autofocusing operates by a series of rules (algorithms). There may be times when these do not give the results you want.

EOS cameras use a highly sensitive line sensor for autofocus ranging. Called BASIS (BAse Stored Image Sensor), it consists of two 48-bit line sensors and associated amplifier circuitry. The sensor is in the base of the camera. A sub-mirror behind the camera's reflex mirror reflects light down to the sensor. This light is split by a small lens assembly to form two separate images. One image is formed on the first line sensor, the other on the second line sensor. If there is no deviation between the two images seen by the sensors, the lens is focused. However, if the spacing of the two images is not correct, a signal is sent to the lens motor to bring the subject into sharp focus.

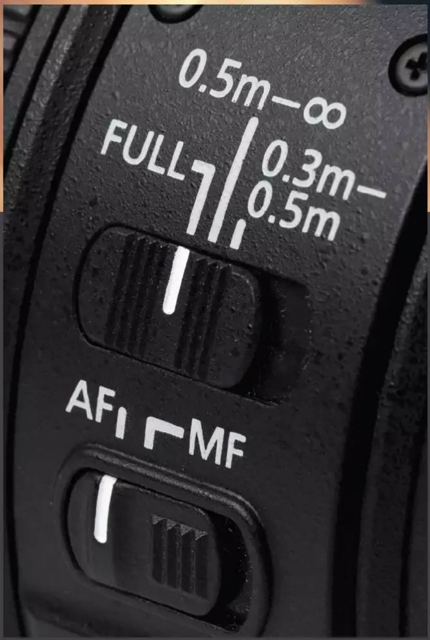
There are a couple of ways to help your camera to focus quickly on a scene. Most digital cameras have the option to select either single or continuous autofocus. Your camera will normally start to focus on the scene as soon as you half-press the shutter button. In continuous focus mode it will continue to update the focus if you then move the camera, but in single AF mode it will hold the same focus setting as long as you hold down the button, until you actually take the shot. You can use this to focus the camera on low-detail targets by finding an object in the scene that's the same distance away as your chosen subject, focusing on that, and then holding the focus and re-framing the shot. Similarly you can use it in reverse to focus on objects that aren't in the centre of the frame.

Moving targets

Compact camera AF systems are usually somewhat slower than those in DSLRs, which means they can have a real problem focusing on moving subjects. The way around this is either to use continuous AF or, if your camera has this option, to use manual focus. If you can tell where your subject is going to be, such as a car going round a tight corner on a race track or a child on a swing, you can pre-focus the camera on this point and wait to take the picture at the right moment. This method takes



> “Autofocus technology has improved immensely, and these days even the most basic modern AF systems are generally fast, accurate and reliable.”



Different lenses have different minimum focusing distances, but many modern zoom telephoto lenses also have macro-focusing capabilities for close-ups.

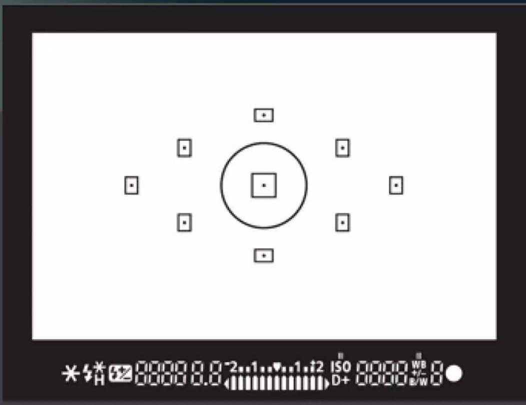
some practice and good reflexes, but it can produce excellent results.

Close-ups

All cameras and lenses have a minimum focusing distance, a closest point beyond which they cannot focus. For many compact cameras this distance can be very small, in some cases as little as 2cm (1in), but for standard DSLR lenses the distances tend to be longer. Most compact cameras have a 'macro' setting, usually denoted by the symbol of a flower. To get closer focusing with a DSLR or CSC, special close-focus macro lenses have to be used.

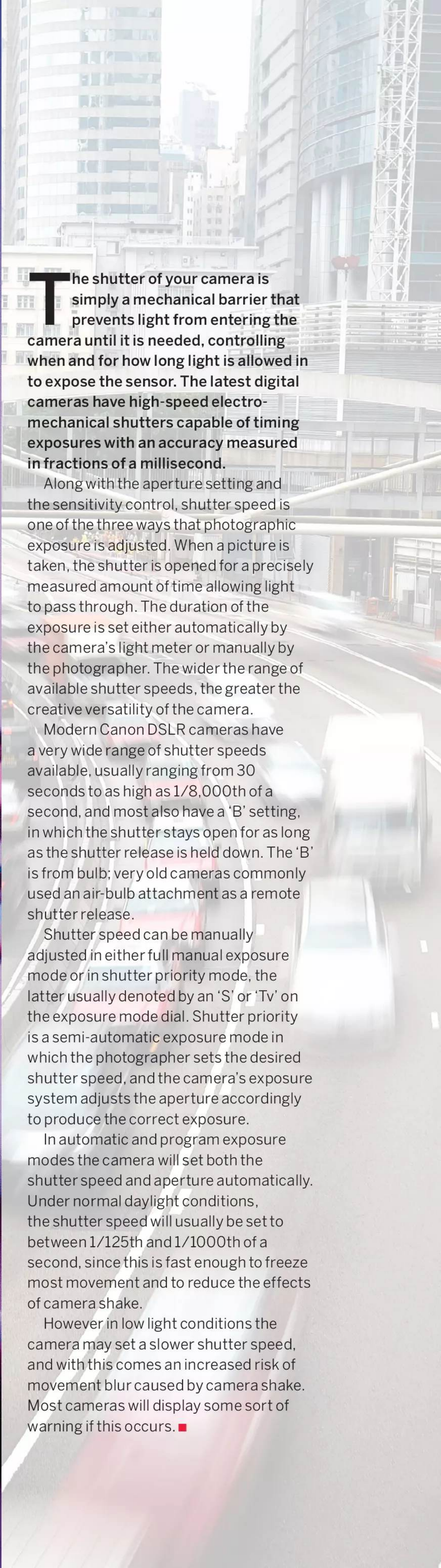
Depth of field is greatly reduced at very close focusing distances, and you may find that your AF system doesn't focus on the right part of the subject, for example if you are trying to photograph the centre of a flower, but the AF focuses on the petals, because they're closer. The best option is to use a tripod, and manually set the focus to the closest distance. Move the tripod until the front of the subject comes into focus, then carefully manually adjust the focus point to get the right part of the flower to look sharp. ■

A typical autofocus array taken from an EOS 600D (US Rebel T3i, Japan Kiss X5). The centre AF point is the most sensitive. Certain AF systems also have extra intermediate focus points.



Shutter speed and camera shake

The shutter of your camera is simply a mechanical barrier



The shutter of your camera is simply a mechanical barrier that prevents light from entering the camera until it is needed, controlling when and for how long light is allowed in to expose the sensor. The latest digital cameras have high-speed electro-mechanical shutters capable of timing exposures with an accuracy measured in fractions of a millisecond.

Along with the aperture setting and the sensitivity control, shutter speed is one of the three ways that photographic exposure is adjusted. When a picture is taken, the shutter is opened for a precisely measured amount of time allowing light to pass through. The duration of the exposure is set either automatically by the camera's light meter or manually by the photographer. The wider the range of available shutter speeds, the greater the creative versatility of the camera.

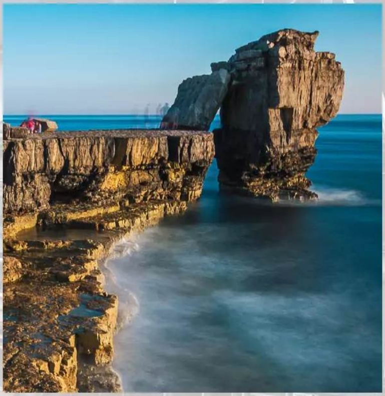
Modern Canon DSLR cameras have a very wide range of shutter speeds available, usually ranging from 30 seconds to as high as 1/8,000th of a second, and most also have a 'B' setting, in which the shutter stays open for as long as the shutter release is held down. The 'B' is from bulb; very old cameras commonly used an air-bulb attachment as a remote shutter release.

Shutter speed can be manually adjusted in either full manual exposure mode or in shutter priority mode, the latter usually denoted by an 'S' or 'Tv' on the exposure mode dial. Shutter priority is a semi-automatic exposure mode in which the photographer sets the desired shutter speed, and the camera's exposure system adjusts the aperture accordingly to produce the correct exposure.

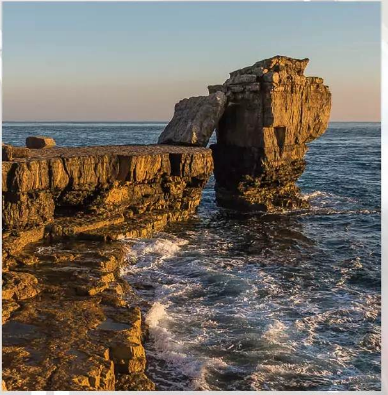
In automatic and program exposure modes the camera will set both the shutter speed and aperture automatically. Under normal daylight conditions, the shutter speed will usually be set to between 1/125th and 1/1000th of a second, since this is fast enough to freeze most movement and to reduce the effects of camera shake.

However in low light conditions the camera may set a slower shutter speed, and with this comes an increased risk of movement blur caused by camera shake. Most cameras will display some sort of warning if this occurs. ■

The misty water effect



One of the most effective uses of long shutter speed is photographing flowing water. It's a beautiful if slightly over-used effect, but it is very easy to achieve. Any moving body of water, flowing stream or waterfall will do, as long as it has white splashing water. This coastal scene is a good example of the effect.

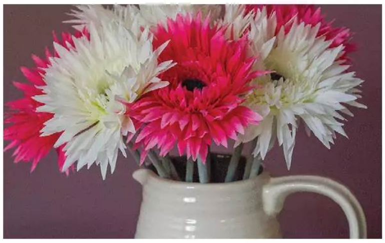


If you just point the camera and shoot on automatic, you'll end up with something like this (above). It looks nice enough, but it's a bit dull. This example was shot on at a shutter speed of 1/125th of a second and an aperture of f8.

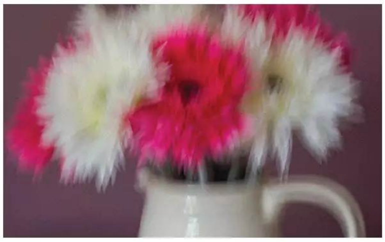
Fixing the camera on a tripod eliminates camera shake. You now need to get the slowest shutter speed you can. The image at the top of the page was taken from the same position as the shot above, but with the addition of a 10stop ND filter to give a longer shutter speed of 30 sec and an aperture of f9.0.

Avoiding camera shake

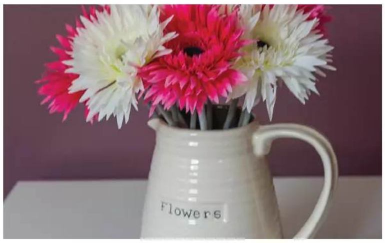
When shooting hand-held and wishing to avoid camera shake, as a rule of thumb you can safely use a shutter speed roughly equivalent to the reciprocal of the focal length you are using. For example if you're using a 100mm focal length then you can take a sharp hand-held shot at a shutter speed of 1/100th of a second or faster. If you're using a 35mm focal length then 1/35th of a second is safe, and so on.



Here's an example shot taken hand-held at a focal length of 50mm and a shutter speed of 1/50th of a second. As you can see it's sharp and shake free.



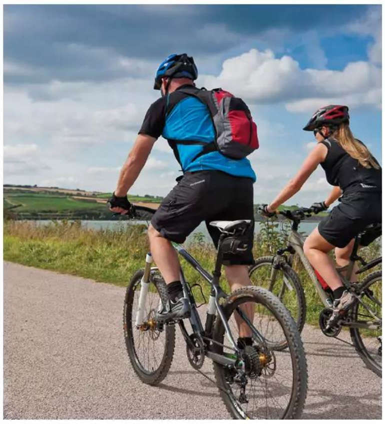
Here's the same hand-held shot at 1/10th of a second. At this speed it's virtually impossible to hold the camera steady enough for a shake-free shot. As you can see, the result is badly blurred.



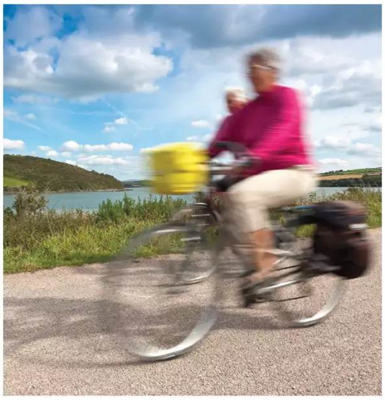
This example shot was taken with a focal length of 50mm at 1/10th of a second as before, but this time the image stabilisation (in this case a sensor-shift system) is switched on. It has detected the vibration and corrected it by moving the sensor to compensate, resulting in a much sharper shot.

Capturing movement

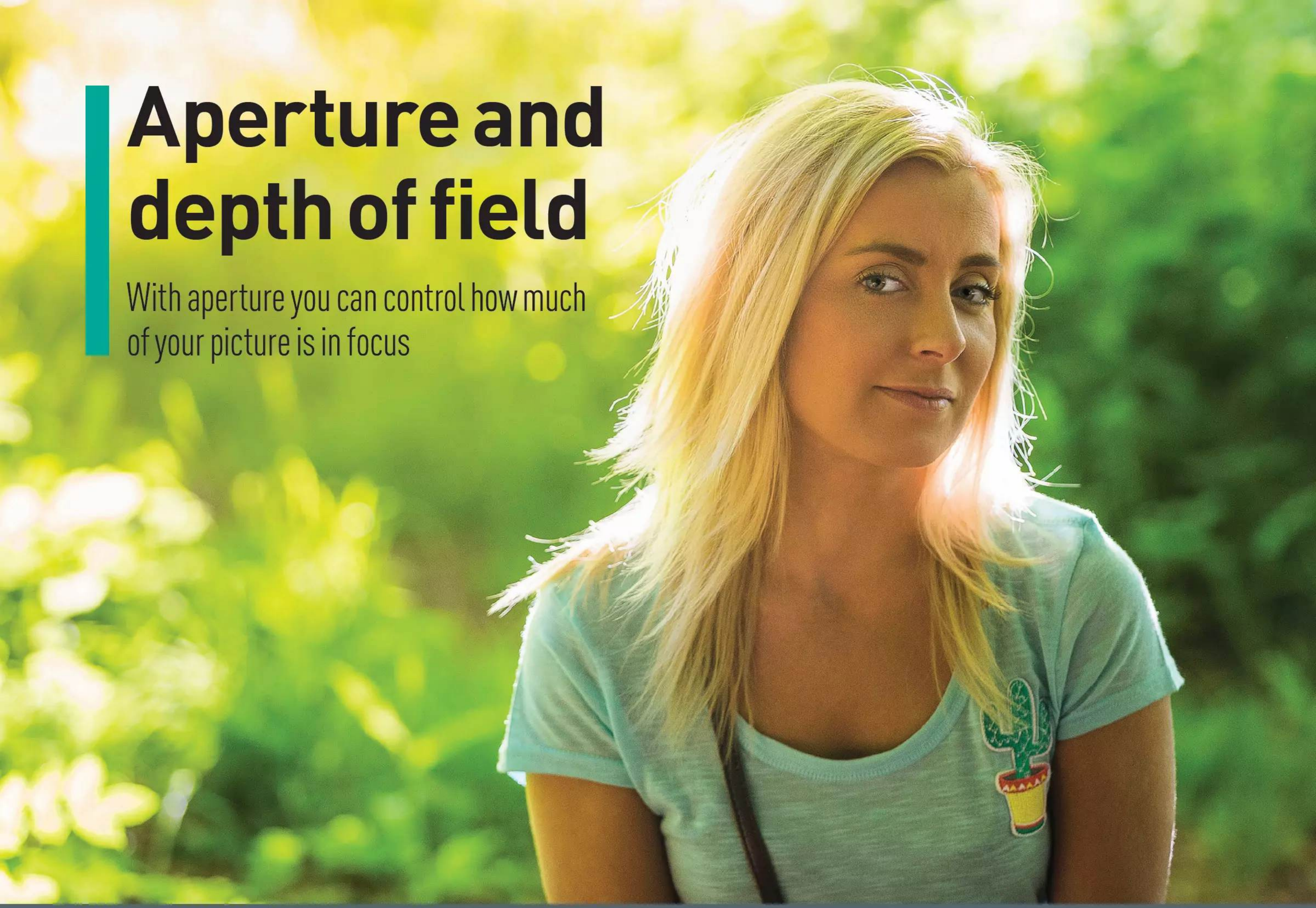
Freezing the action with a fast shutter speed produces a nice sharp image, but sometimes you might want to allow a controlled amount of movement blur to show that the subject was in motion. Below is a quick guide showing how this can be accomplished quite easily.



In this first example, the camera was fixed on a tripod, with a shutter speed of 1/250th of a second, while the subjects cycled past in front of the lens. The tripod ensures that the background is sharp and the fast shutter speed has frozen the movement. The result is sharp but looks slightly unnatural, as though they were somehow balancing there without moving.



With the camera still mounted on the tripod, the shutter speed was set to 1/10th of a second, and another subject came past. This time the background is still sharp, but the slow shutter speed has resulted in lots of movement blur, making the subject almost unrecognisable.



Aperture and depth of field

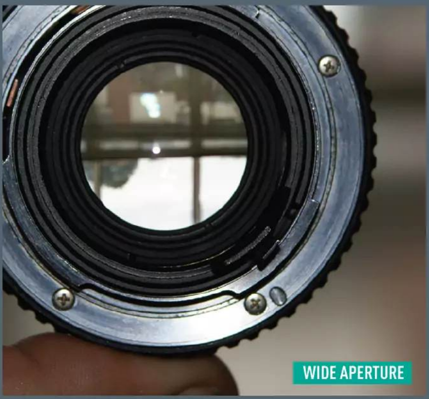
With aperture you can control how much of your picture is in focus

Using a very wide aperture and precise focusing, emphasis can be given to one subject to effectively isolate it from its surroundings.

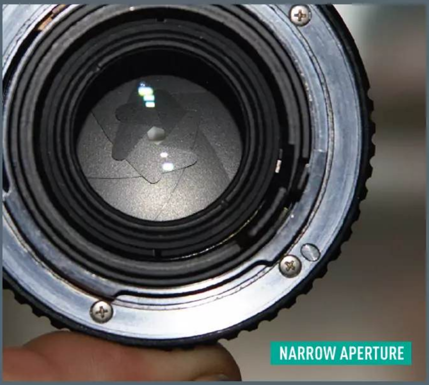
Of the three main controls common to nearly all cameras – shutter speed, focus and aperture – it is aperture adjustment that is the least well understood. This is because it not only helps to control exposure, but also affects something called Depth of Field. Understanding the effects of aperture size is a vital skill for any keen photographer.

At least there's nothing mysterious about the name. The aperture is literally a hole through which light passes after it enters the lens. The diameter of this hole can be altered, allowing a greater or smaller amount of light to pass through on its way to the sensor. In the early days of photography, aperture was adjusted by slotting cards with different sized holes cut in them into the body of the camera behind the lens. These cards were known as 'stops', and this is still part of photographic terminology today. On modern cameras the aperture is controlled by an arrangement of curved shutters inside the body of the lens, which move to produce a continuously variable aperture, however the aperture settings are usually still referred to as 'F-stops'.

Aperture adjustment is used in combination with the shutter speed and ISO sensitivity to control photographic exposure. However it is also the primary means of controlling something



WIDE APERTURE



NARROW APERTURE

called depth of field, a concept that may need a bit of explanation.

If you take a photo of a subject at a distance of about 3 metres with a standard zoom lens, in good light with the focal length set to about 30mm, as long as the lens is focused correctly the subject should appear nice and sharp in the image. However you'll usually find that objects about 1.5m in front of the subject, and for about 4 or 5 metres behind the subject, also appear sharp. This distance, from the closest point of acceptable sharpness to the most distant, is known as the depth of field.

By altering the size of the aperture it is possible to control the extent of this depth of field, either reducing it so that only the main subject is in sharp focus, or expanding it so that an entire landscape can appear to be just as sharp.

If you have an older camera to hand, take a look at the lens. It will have a ring for controlling the aperture setting, labelled with numbers usually from about F2 to about F22. The focus control ring will have distances usually calibrated in feet and metres, and alongside it you'll usually find lines marked with the same numbers as the aperture ring, arranged in pairs either side of the focal distance mark with the larger numbers toward the outside.

The purpose of this aperture scale is to help estimate the depth of field at a particular distance for any given aperture setting; with the focus set to a particular distance, anything between the two lines for the selected aperture setting should be acceptably sharp. Some older zoom lenses have a series of curved lines etched into the lens barrel for the same purpose. For some reason this scale is missing from most modern autofocus, auto-aperture lenses, which is a shame because it makes the whole concept of depth of field that much easier to understand. ■

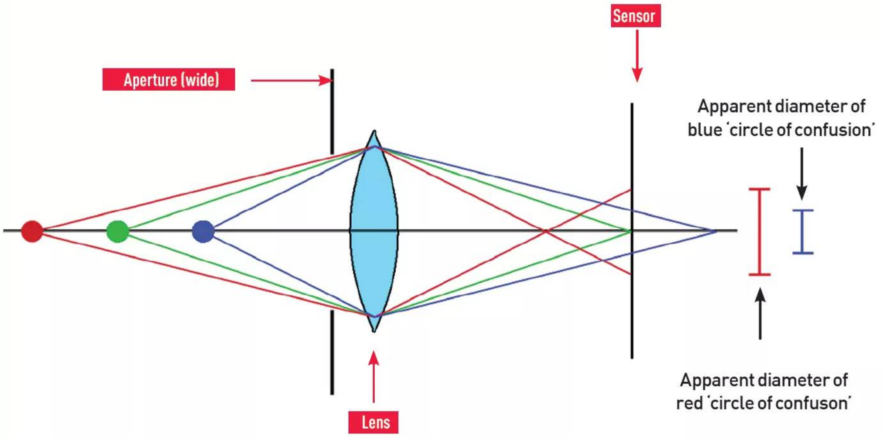
APERTURE RING
∞ 10 5
4 8 16
5.6 4 2.8 2
4 10 ∞
16 11 8 4 R
16 11 8 5,6 4

How aperture works

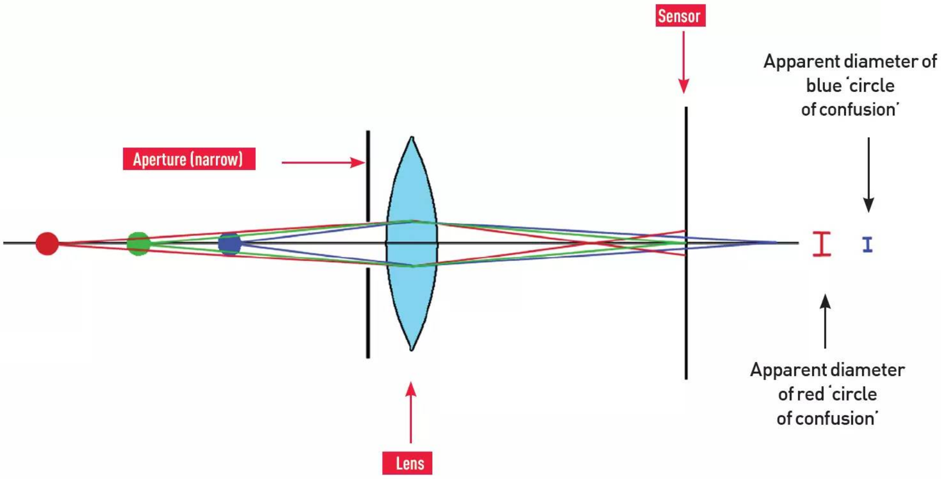
Explaining exactly why altering the size of the lens aperture alters the depth of field is a little complicated, but a few simple diagrams should help to shed some light on the matter. For a start, let's clear up some popular misconceptions about the difference between focus and sharpness.

This is a highly simplified diagram of the arrangement of lens, aperture and sensor inside a modern digital camera. In this first diagram, three subjects at different distances from the camera lens are represented by the red, green and blue dots. The lens is focused on the green spot, so light from it passes through the aperture and the lens and appears sharply focused on the sensor. Light from the red and blue spots also passes through the aperture and lens, but light from the red spot focuses a short distance in front of the sensor, while light from the blue spot focuses a short distance behind it. The light from these other spots still hits the sensor, but due to light scattering it is unfocused and spread over a wide area.

What this means is that the red and blue spots will appear as large blurred spots on the final image, while the green spot will be sharp and in focus. The size of the blurred area of the red and blue spots is called the 'circle of confusion.'


Sensor
Aperture (wide)
Apparent diameter of blue 'circle of confusion'
Lens
Apparent diameter of red 'circle of confuson'

The diagram below shows the same arrangement of camera and subjects, and the coloured spots are the same distance from the lens, but this time the aperture has been reduced to just a small hole. Again the lens is focused on the green spot, and the red and blue spots are out of focus. However the narrow aperture restricts the light scattering and the relative angles of the light paths, and as a result the 'circles of confusion' are much smaller. This makes the red and blue spots in the final image appear much sharper. They are still out of focus, but the effect is not so noticeable. To make circles of confusion as large as in the first image, the red and blue spots would have to be much further away from the green one.


Sensor
Apparent diameter of blue 'circle of confusion'
Aperture (narrow)
Apparent diameter of red 'circle of confusion'
Lens

Aerobytes
The Blades
Aerobytes
The Blades

Focal length and zoom

Understanding how focal length works in composing shots

Nearly all modern compact cameras have zoom lenses, and most users of digital SLRs or CSCs will also have at least a couple of zooms in their kit. Focal length is one of your primary tools for adjusting composition. Selecting the right focal length for the scene allows the photographer to control perspective, angle of view and magnification, and can radically alter the mood and style of the photo. Some focal lengths are more suited to particular types of photo, and the properties of wide-angle and telephoto lenses can be used to produce particular effects. Understanding how focal length works and how it affects your photos is a vital photographic skill. ■

Lenses and focal length

There are basically two types of lens; those with fixed focal lengths, also known as prime lenses, and those with variable focal length, or zoom lenses. They both have their own advantages and disadvantages. Prime lenses are usually smaller and lighter than zooms, and also generally have much faster maximum apertures than a zoom lens at equivalent focal length. The optical quality of prime lenses is also usually a little higher than the equivalent zoom lens. Zoom lenses however are much more convenient, allowing the photographer to cover a wide range of focal lengths with just one or two lenses, rather than carrying around a bulky collection of prime lenses. There are some fast zoom lenses, but they tend to be extremely expensive.

The focal length of a lens is an expression of its magnifying power, and is usually stated in millimetres. If you look on the front of your camera, usually inscribed around the front of the lens you'll find the focal length, or a range of values for zoom lenses. For a typical DSLR kit lens this will usually be around 18-55mm. For digital cameras it is fairly usual to see two figures quoted, both the actual focal length and the 'equivalent' length. The reason for quoting both is simply that more people are more familiar with the sizes of 35mm lenses, so they know that 28mm is wide angle and suitable for panoramic shots, or that 200mm is a telephoto, suitable for long-range subjects.

Real and equivalent focal lengths are different because most digital camera sensors are a lot smaller than a frame of 35mm film, and are fitted much closer to the lens than the film would be. Most consumer DSLRs use the APS-C sensor format. Exact sizes vary from one manufacturer to the next, but are typically around 22.5 x 15 mm. A frame of 35mm film measures 36 x 24mm, which means that the edges are 1.6x longer, so the focal length of the lens would need to be 1.6x greater to produce the same image size and magnification. This is usually referred to as the 'conversion factor' or 'crop factor'. It means that a typical 18-55mm DSLR zoom lens is roughly equivalent to the popular 28-80mm zoom lens often used on full-frame 35mm systems.

Compact camera sensors are even smaller still. Because there are several different sizes of sensor in common use it is more usual for compact camera zoom lenses to be rated in terms of their magnification power, such as 3x, 4x, 10x etc. This relates to the difference between the minimum and maximum focal lengths. A lens with a range of focal length from 5.8mm to 17.4mm is called a 3x zoom, because 17.4 = 3 x 5.8.

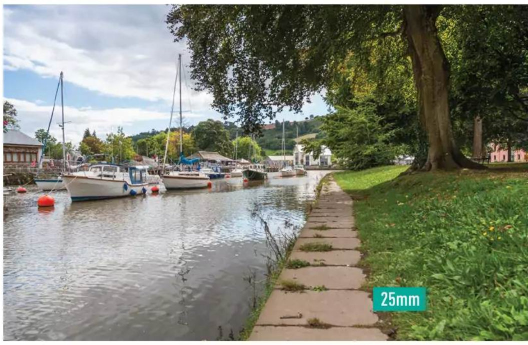
While in older prime lenses a 200mm lens would literally be 20cm long, modern optical systems use multiple lens elements working in combination, which means that the light path can be shortened while still maintaining the same effective magnification. As a result quite powerful telephoto and zoom lenses can be relatively compact.

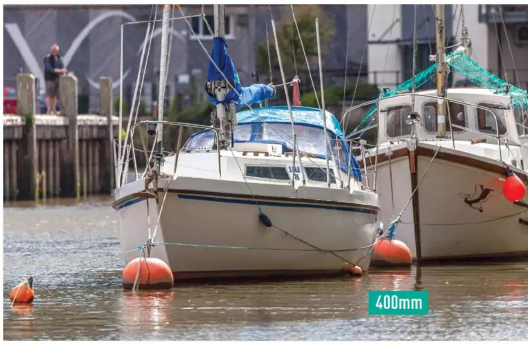
Wide-angle and telephoto are relative terms. On a 35mm film SLR a 50mm lens produces approximately the same perspective and magnification as the human eye, and has traditionally been the standard lens for this type of camera. Anything longer than 50mm is considered a telephoto, while anything shorter is considered wide angle. Digital SLRs tend to follow this rule too, although considering the crop factor the mid-point is about 35mm. ■

The shots seen in this set of examples were taken with the 24-105mm f/4 L (above) and the 100-400mm f/4-f/5.6 L zoom lenses.

Magnification

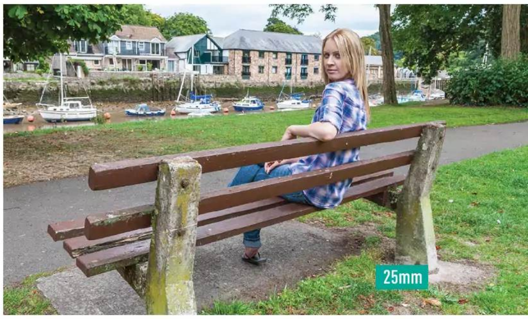
The most obvious effect of altering focal length is the change in magnification. Anyone who has ever used a zoom lens will be familiar with this effect. If you want to take a photo of something a long way away, you zoom in and the subject appears closer.

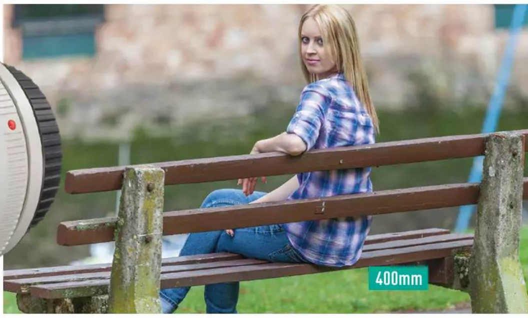




Angle of view

Changing the angle of view can be used to produce some interesting effects. If we move closer to the subject while shortening the focal length we can see that although the subject fills roughly the same area of the final image, in a wide angle shot a lot more of the background is included.





Exposure and metering

Accurate exposure is the key to good photography

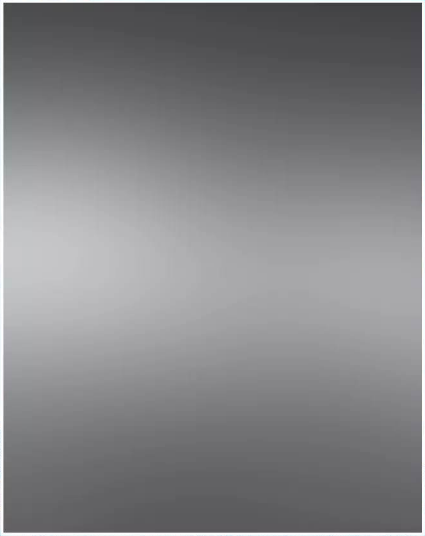
Understanding exposure and how it affects your photographs is probably the single most important technical skill you can learn in photography. It's certainly the one that most people get wrong, and apart from camera shake bad exposure probably ruins more photos than any other single cause. The main problem is over-reliance on automatic metering.

Most modern cameras, even relatively cheap compacts, have sophisticated built-in TTL multi-zone evaluative exposure meters that measure light levels at dozens, in some cases hundreds, of points within the frame, instantly comparing the results with a built-in library of exposure situations and automatically adjusting the shutter speed and aperture to deal with problems such as back-lighting, close-ups or moving subjects.

In most cases these automatic exposure systems are very good, and can reliably cope with most common circumstances. However even the best automatic meter can be fooled, resulting in poorly exposed photos. By overriding the camera's automatic settings and adjusting exposure manually we can avoid these problems and take much better photos.

Fade to grey

Take a look at this picture. What you see here is a nice scene of a mountain range, with a good tonal range, plenty of colour and some nice crisp sunlight. What your camera's lightmeter sees is this:



The photographers trinity. Aperture, ISO and shutterspeed. One always has an effect on the others. A basic principle, but an important one.

ISO
ISO 100
±0

Shutter speed

Try it out for yourself. Find any nice, average snapshot scene, properly lit and with good contrast. Start up your image editing software and open your picture. Lightmeters only see in black and white, so reduce the saturation of the shot to zero. Your light meter doesn't see detail, so set your Gaussian blur filter to maximum diameter and apply it a couple of times. Use the eyedropper tool to measure the RGB colour value of the resulting tone. You should find that it averages out to a mid-tone grey with an RGB value of around 127,127,127.

It's an interesting and curious fact that any average scene reflects 18% of the light falling on it. Look out of your window, and unless you live in Antarctica the scene you see is reflecting exactly the same amount of light as the scene out of my window. That 18% reflection is exactly the same as a mid-tone grey, mid-way between black and white.

Light meters are calibrated with this fact in mind. When your camera takes a light reading, the meter averages the scene and adjusts the exposure to produce that mid-tone grey (or 12% luminance, but that's another discussion altogether). If you point the camera at a black stage curtain, it will try to make the black into a mid-tone grey, so it will over-expose. If you point it at snow it will try to make the white into grey, so it will under-expose.

Adjusting exposure

Let's take a moment to explain how exposure is controlled, and what is meant by some of the terminology used.

On all cameras, exposure is adjusted by altering three basic settings; aperture, ISO and shutter speed. Between them they control the exposure of any shot.

Shutter speed is self- explanatory, it is simply the amount of time that the sensor is exposed to light. This is usually controlled by an electrically operated mechanical shutter in front of the sensor that opens and closes very quickly for a precisely measured period of time, usually in the order of a few hundredths of a second. Obviously a shutter speed twice as long lets in twice as much light, one half as long lets in half as much.

The aperture is literally just a hole through which light passes on its way to the sensor. The diameter of that hole can be adjusted to precisely calibrated sizes. A smaller hole lets in less light, and a larger hole lets in more.

These calibrated aperture sizes, for largely historical reasons, are called stops, or f-stops. An aperture setting one stop larger lets in twice as much light. For reasons that are both historical and mathematical, the standard full-stop aperture settings that you are most likely to encounter go f/1, f/1.4, f/2, f/2.8, f/4, f/5.6 f/8, f/11, f/16 and f/22. The smaller numbers refer to larger apertures, and the larger numbers to smaller ones. Many cameras can set apertures in increments of 1/3rd of a stop, but the whole-stop numbers are the ones to remember.

ISO is just the sensitivity of the sensor to any light that falls upon it. A low ISO setting means it is less sensitive to light, producing very clean images but withe the result of needing longer shutter speeds or wider apertures, whilst a high ISO means it becomes very sensitive to light. The practical upshot of this is that you can increase the sensitivity of your sensor to give you the option of shorter shutter speeds and smaller apertures at the expense of a greater amount of noise in the image.

Let's consider an example. With your camera set to automatic exposure point it at a scene and take a light reading. For the sake of argument, say the light meter sets an aperture of f8 and 1/200th of a second. You can produce the same exposure by increasing the aperture by one stop to f5.6 and halving the shutter speed to 1/400th of a second, because this lets the same amount of light through to the sensor. Similarly, reducing the aperture to f11 and setting the shutter speed to 1/100th of a second will also produce the same exposure.

However by altering one setting without altering the other you will change the exposure. In our example, changing the aperture to f5.6 but leaving the shutter speed at 1/200th of a second will increase the exposure by one stop, or one exposure value (EV), making the picture brighter. Decreasing the aperture to f11 will reduce the exposure by one EV, making the picture darker.

Similarly, changing the shutter speed while leaving the aperture alone will also change the exposure. Double the shutter speed to 1/400th at f8 and you reduce the exposure by one stop, halve the speed to 1/100th and you increase the exposure by one stop.

Once you grasp the concept that all these factors are linked and that one will always affect the other, you are well on your way to understanding exposure and how to get more creative control of your images. ■

Be the master of metering

Know when to use the different types of metering modes

Nearly all digital cameras, from top-of-the-range DSLRs to the humblest budget point-and-shoot compacts, have multiple light metering options. Knowing how and when to use these different metering modes can make a dramatic difference to the quality of your photography; unfortunately most people don't understand what the different modes are for, how they work, or how to use them.

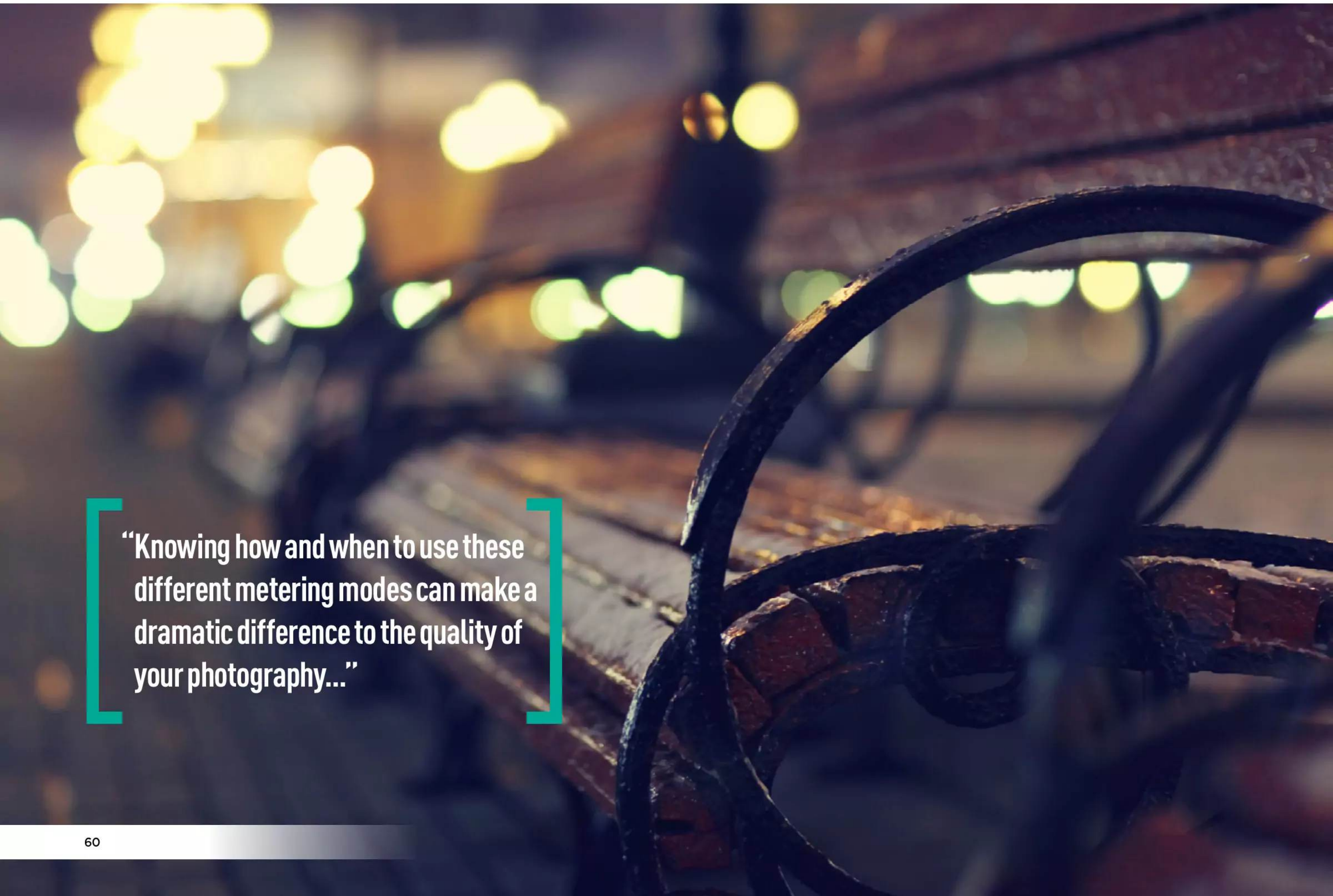
Know your modes

Depending on your camera, you'll find metering options either in the menu or with their own separate control. In cameras with a fully-automatic setting, this will usually disable the metering options; automatically selecting multi-zone metering as the best option for day-to-day scenes and snapshots. The most common light metering modes are found on nearly all digital cameras. They are spot metering, centre-weighted metering and matrix metering. The symbols used for these modes are just about universal. Multi-zone metering is shown by a rectangle filled with a centre spot surrounded by a pattern of shapes; centre-weighted metering is usually shown as a centre spot with shapes above and below it; whilst spot metering is usually a rectangle with just a centre spot.

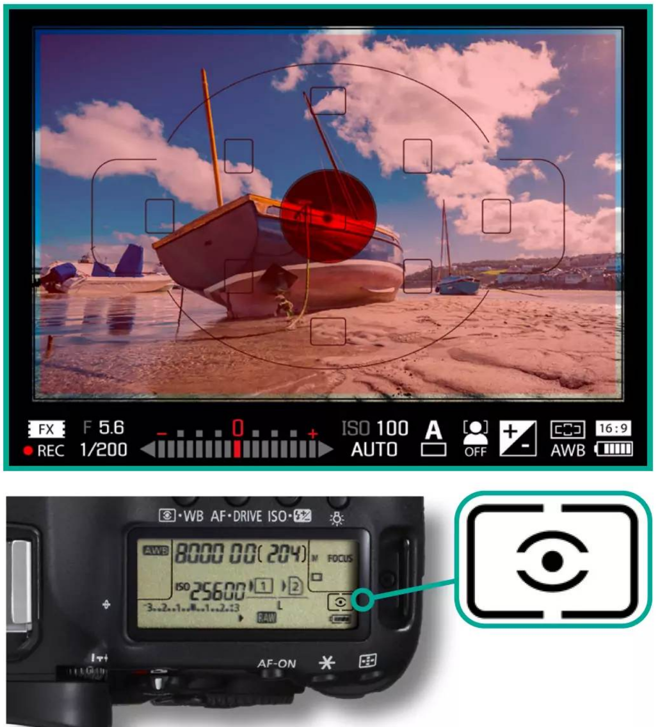
What they do

Matrix metering, also known as Evaluative metering, is usually the default setting and it is a great multi-purpose metering mode for evenly lit scenes and places emphasis around the AF point used while applying appropriate exposure compensation. Centre-weighted behaves a lot like Matrix metering but it place more emphasis on the centre of the image and doesn't take the AF point into consideration. Spot metering is the most accurate by metering the scene over a very small circular area. Partial metering takes the precision of spot metering and expands the size of the circle used to measure the light. ■

Getting your exposure correct at the time of shooting means that you are retaining more detail in the file; this can be enhanced when it comes to post-processing.

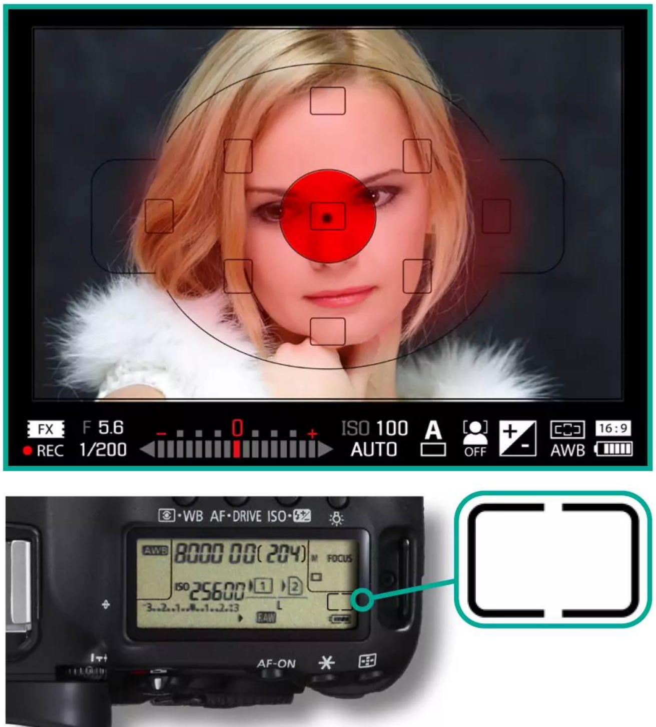


"Knowing how and when to use these different metering modes can make a dramatic difference to the quality of your photography..."


FX
F 5.6
REC
1/200
0
ISO 100
AUTO
A
OFF
AWB
16:9
WB AF·DRIVE ISO
8000 00(204)
ISO 25600
FOCUS
RAW
AF-ON

Matrix or Evaluative metering

This mode is great for evenly lit scenes where there are not a lot of tonal variations. It meters the whole scene and is usually the default metering mode on a camera.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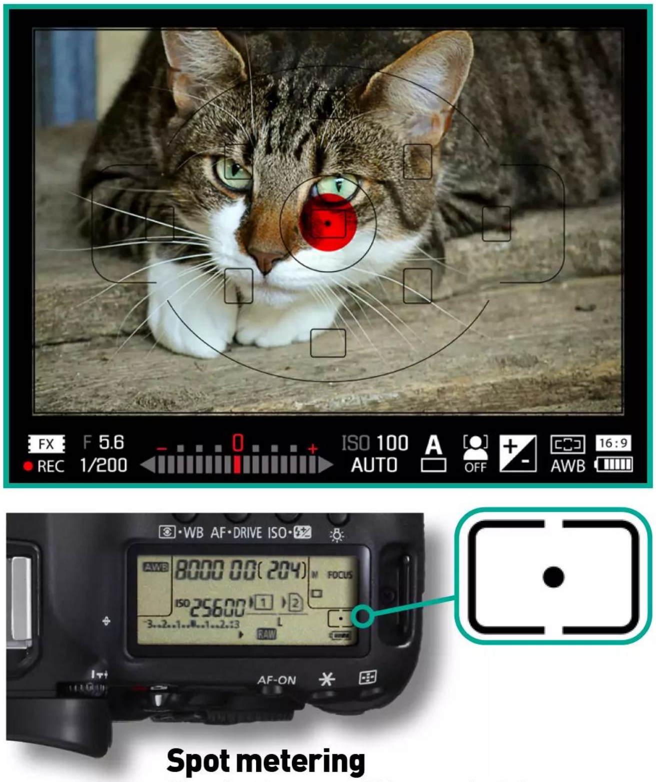
F 5.6
REC
1/200
0
ISO 100
AUTO
A
OFF
AWB
16:9
WB AF·DRIVE ISO
8000 00(204)
ISO 25600
FOCUS
RAW
AF-ON

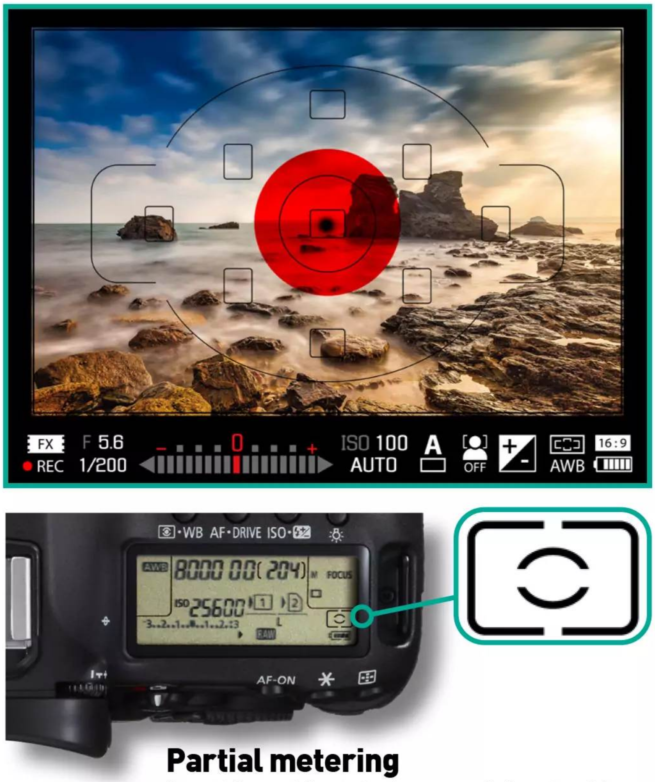
Centre-weighted average

Since this mode concentrates on the central portion of the frame, it makes it perfect for portraits and head shots. Details around the edge of the frame are not metered.


FX
F 5.6
REC
1/200
0
ISO 100
AUTO
A
OFF
AWB
16:9
WB AF·DRIVE ISO
8000 00(204)
ISO 25600
FOCUS
RAW
AF-ON

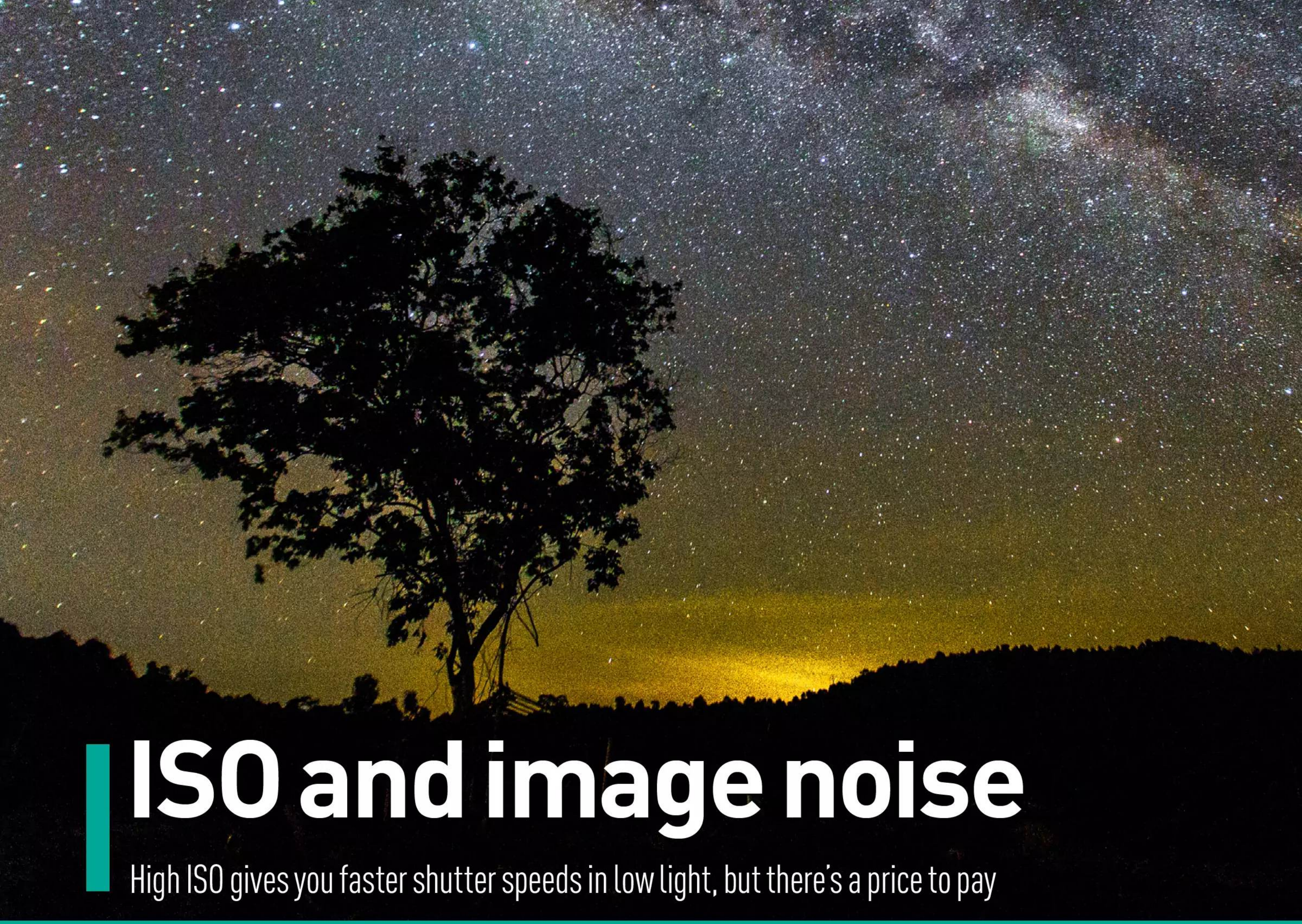
Spot metering

When shooting scenes with large tonal variation, spot metering allows you to pick exactly which part of the scene you want to accurately meter for.


FX
F 5.6
REC
1/200
0
ISO 100
AUTO
A
OFF
AWB
16:9
WB AF·DRIVE ISO
8000 00(204)
ISO 25600
FOCUS
RAW
AF-ON

Partial metering

Essentially, partial metering is an expanded version of the spot metering mode. This makes it easier to use although the metering is not quite as precise as the spot meter mode.



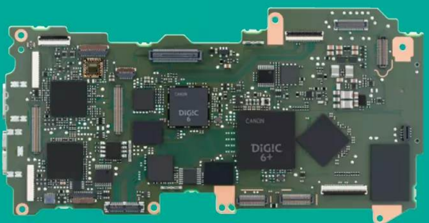
ISO and image noise

High ISO gives you faster shutter speeds in low light, but there's a price to pay

Anyone who has owned a digital camera for a while will be familiar with the concept of image noise. It's that grainy distortion that spoils pictures shot in low light conditions with high ISO settings. What is image noise, where does it come from and what can be done to prevent it?

All electronic devices generate noise. The background hiss of a radio, the sound of an over-amplified electric guitar, or the interference on a badly tuned television, all of these things are electronic noise, and so is the noise seen in a digital photograph.

This noise comes from a variety of sources. Some of it is generated by imperfections in the electronic components, or as a by-product of their normal operation. For instance, capacitors generate a small amount of noise as they charge and discharge. Electronic components can also be affected by environmental noise, such as the electrical fields that constantly surround us.



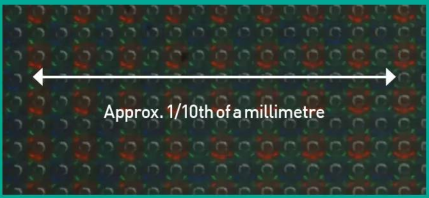
This is the main circuit board from a Canon EOS 5D MkIV digital SLR, showing the powerful DIGIC6 and DIGIC 6+ image processing chips.

Circuit noise can be minimised by superior manufacturing and rigorous quality control. Unfortunately some cheaper camera brands, or even budget models from better-known brands, may use components of lower quality, which is why these types of camera generally produce noisier images than the more expensive models.

Sensor noise

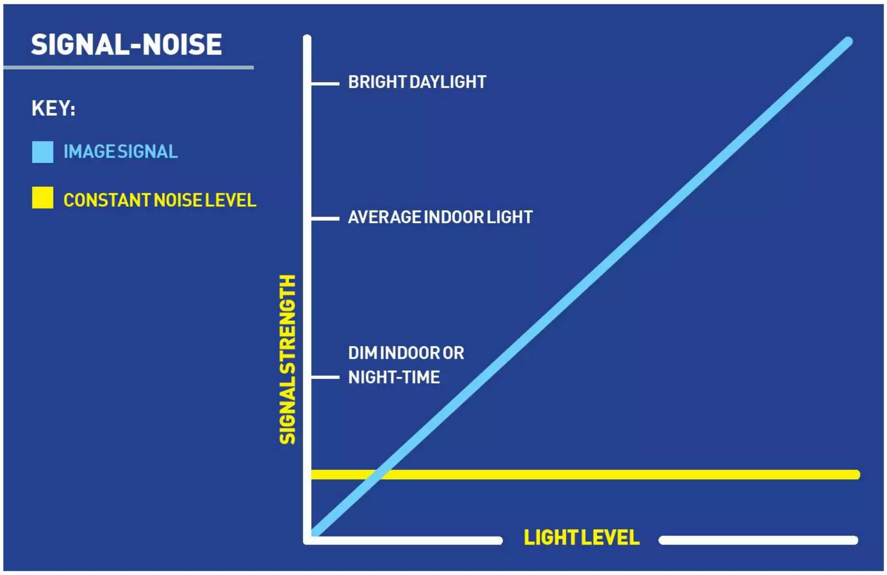
The other main source of image noise is the sensor itself, and in most cases this is unavoidable. The individual photocells on a digital camera sensor are incredibly small, especially with high-resolution compact camera sensors.

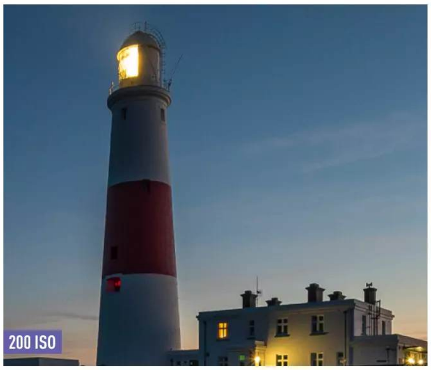
Most compact camera sensors have over 10 million individual photocells crammed into an area of less than 30 square millimetres. These photocells are so small that in low light conditions they may only be collecting a few thousand photons (individual light 'particles') during an exposure, so the level of the electrical signal produced by the cell can be affected by random statistical fluctuations in photon density. This is the main reason that physically larger sensors are much better than smaller ones. The individual photocells are larger and collect proportionately more light during the exposure producing an inherently higher signal to noise ratio.



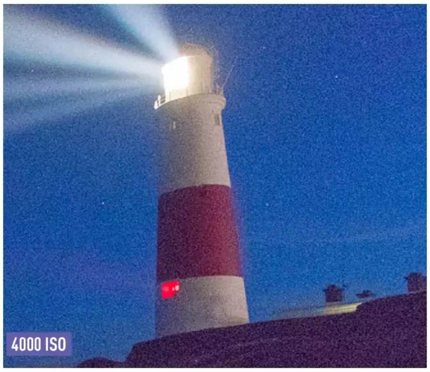
Actual microscope photograph of the surface of a Nikon CCD, showing the Bayer mask filter and microlenses

The level of noise produced by the sensor and other components in the camera is usually constant and at a fairly low level. When taking photographs in good light the level of the signal vastly outweighs the level of noise; in other words the signal to noise ratio is very high, and consequently noise isn't a problem. The





200 ISO



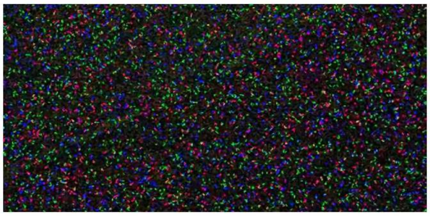
4000 ISO

> “A higher sensitivity increases the amount by which the signals from the sensor are amplified... unfortunately the noise gets amplified as well.”

problems start when shooting in low light, as the level of the signal drops nearer to the constant noise level, producing a lower signal to noise ratio. At extremely low light levels the signal may be entirely drowned out by the noise.

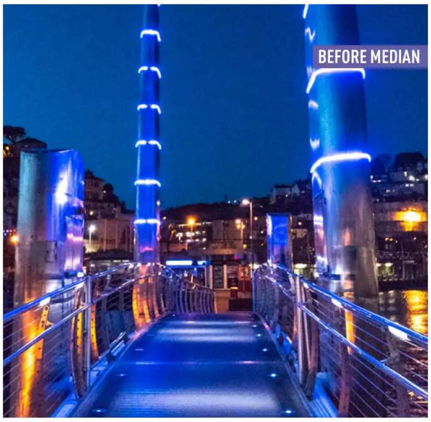
This problem is made worse when shooting at higher ISO settings. When we set a higher sensitivity we are increasing the amount by which the signals from the sensor are amplified, and unfortunately the noise gets amplified as well. If the signal to noise ratio was already very low then this just produces more noise without improving the image. This is why high ISO images are always more noisy than ones taken at lower settings.

Another type of sensor noise can also be a problem when using exposures longer than a couple of seconds. Sometimes the photocells that make up the sensor may not all respond to light to an equal degree, causing single pixels to appear very bright or very dark. The charge build-up over a longer exposure makes this problem more noticeable. Since the pattern of these “dead” or “hot” pixels is usually consistent from one frame to the next this type of noise is remedied by applying a filter during image processing. Most modern cameras do this automatically but it can be a problem on older models. Images taken on older cameras can show a lot of “hot” pixels, especially during long exposure photographs with no long exposure noise reduction. Below is an example of how bad it can get.

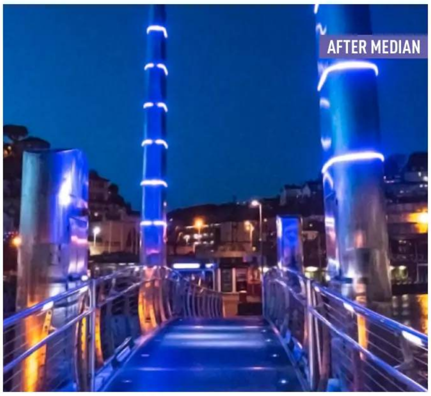


Noise reduction

Cameras reduce image noise by using smoothing filters during image processing. The most commonly used is called a Median filter. This works by comparing each pixel to the ones surrounding it, and if it has a brightness that is different from its neighbours then it is replaced by a new pixel with the average value of the nearby pixels. This eliminates noise effects, but also reduces detail and contrast. Compare these next two images. The first is unfiltered, the second has had a median filter applied. The second image is “cleaner”, but as you can see the level of detail has been greatly reduced.



BEFORE MEDIAN



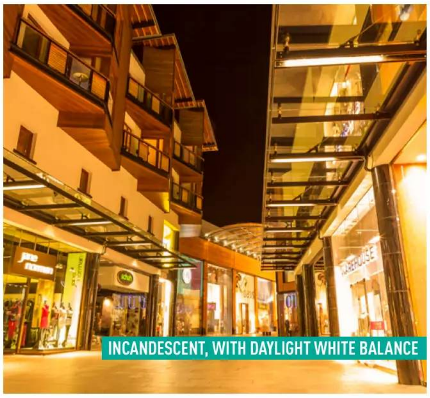
AFTER MEDIAN

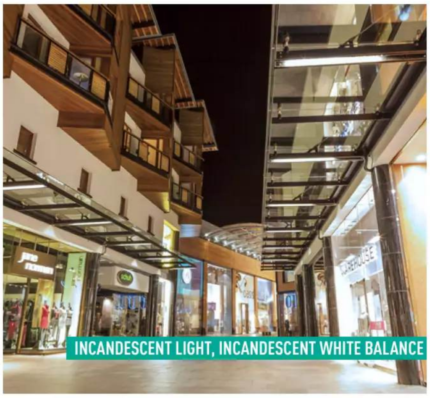
Another type of noise reduction is called “pixel binning”, although this is less widely used in recent digital cameras. In this process, the signals from groups of four, nine or even 16 adjacent photocells are grouped together into a “super pixel”. This has the effect of increasing the signal to noise ratio, but of course it also reduces the effective resolution of the image. It increases the signal to noise ratio, but it also reduces the quality of the image.

The only effective remedy to image noise is to use larger, more sensitive photocells. Digital SLRs have a major advantage in this area, since they have physically larger sensors. Compact camera sensor technology continues to improve, both in image processing and sensor design. We will undoubtedly see further advances in the future, but for now image noise is something we just have to accept. ■

White balance

White may not be as white as you think


INCANDESCENT, WITH DAYLIGHT WHITE BALANCE


INCANDESCENT LIGHT, INCANDESCENT WHITE BALANCE

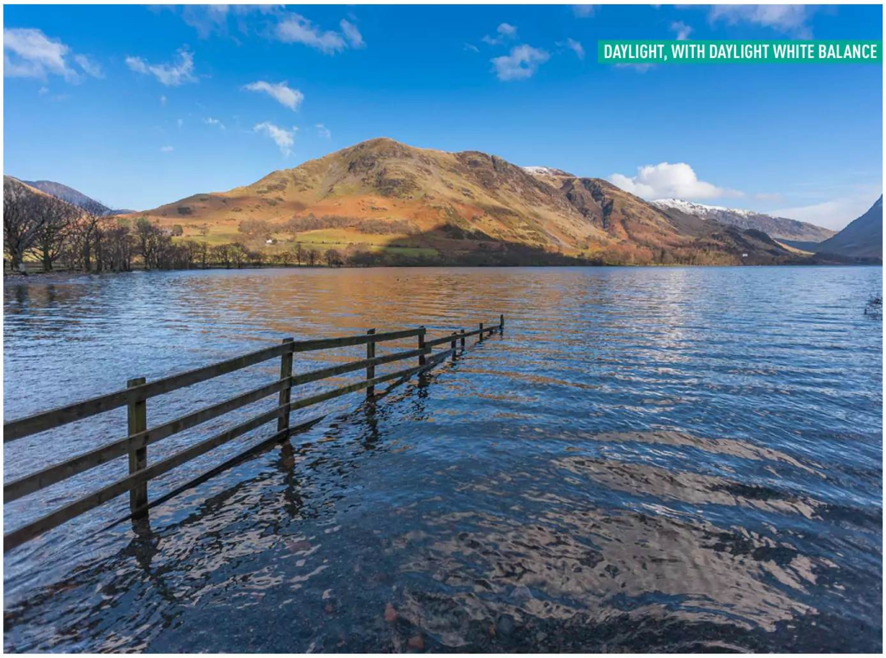
When you look at, for example, a sheet of white paper, your brain adjusts what you see so that it matches what you are expecting to see. However your digital camera doesn't have any expectations, and the colour that it "sees" is the actual colour present in the scene.

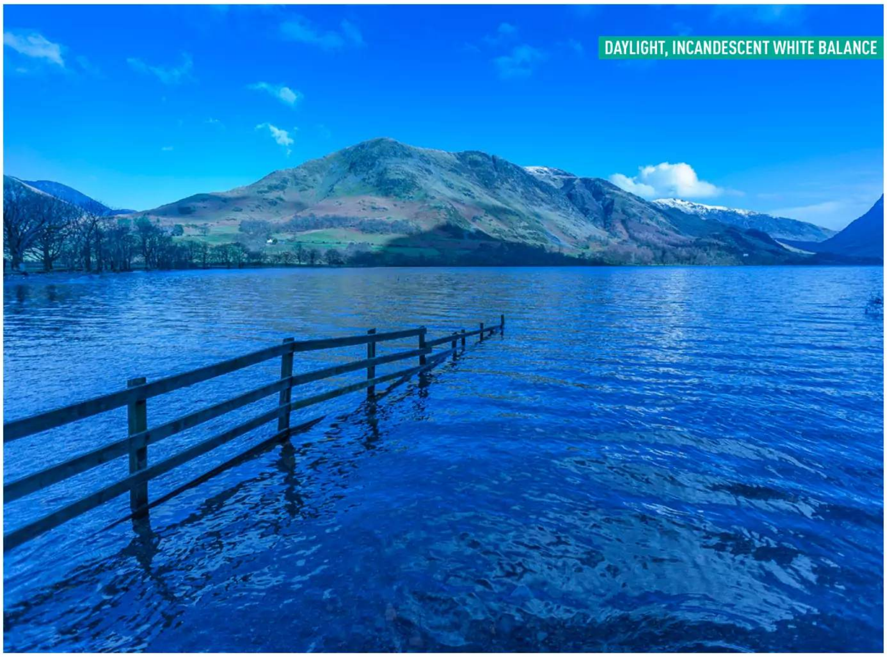
'White' light visible to humans can actually vary in colour from reddish orange to greenish-blue. This variation is usually described as a temperature range, with warm being the red end and cold at the blue end, and is usually measured in degrees Kelvin using a colour meter. Confusingly, the higher the colour temperature, the cooler the tone and vice versa.

We perceive various shades of white light illuminating a scene as neutral, a clever trick performed by our brains to maintain a sense of normality. Digital cameras can perform the same trick using a feature called automatic white balance. The camera evaluates the scene through the lens, analysing areas it guesses should be white (highlights) and black (shadows). More expensive cameras have a more reliable ambient white balance sensor that measures the temperature of general, focused light. However these automatic systems can be fooled, so most cameras give you the option of setting the white balance manually, either from pre-sets that cover most normal lighting conditions or by making an accurate measurement of the prevailing lighting conditions.

In the example pictures on this page you'll see an image with ordinary incandescent light bulbs, also called tungsten lighting. As you can see, when the camera is set to the warm artificial light white balance setting that suits this lighting, the light areas of the scene are neutral. The same scene looks very different when the camera's white balance is set to normal daylight colour temperature. Now there is a distinct reddish-orange cast. Light bulbs can shine with various colour temperatures. Cheap traditional, low wattage light bulbs tend to be the warmest in colour, while low voltage halogen bulbs are cooler in tone.

Another example is a typical noon day outdoor scene where the ambient white light temperature is cool. When the camera's white balance setting matches the cool tone of the brightness of the sun, everything looks quite normal. On the other hand, if the camera has been set for tungsten artificial light, the scene appears to have a very


DAYLIGHT, WITH DAYLIGHT WHITE BALANCE


DAYLIGHT, INCANDESCENT WHITE BALANCE

blue cast. Sunlight, like artificial light, can vary quite considerably in colour temperature. Early morning and late afternoon daylight is warmer as cooler components of the light are filtered out because it has to shine through more atmosphere and its pollutants as the sun is nearer the horizon. Meanwhile, cloudy and overcast conditions deliver a cooler light because warmer components are filtered out by the cloud.

Our third example is lit with fluorescent lighting, and presents an even harder challenge for your digital camera. The visible spectrum of fluorescent light is not a nice smooth line, it's full of peaks and troughs. Some fluorescent lights have a green cast and others a pink cast. These differences are visibly evident where strip lights of different tone have been fitted side by side. So-called daylight tone fluorescent lights are not equivalent to real daylight. Better digital cameras will have a number of presets for fluorescent light to help you match the white balance in these conditions more accurately. In our example here, the fluorescent light is a greenish yellow in tone.

Know your camera

Nearly all digital cameras offer white balance adjustments accessible either from a settings menu or, typically on higher spec cameras, via an external button in conjunction with an LCD display.

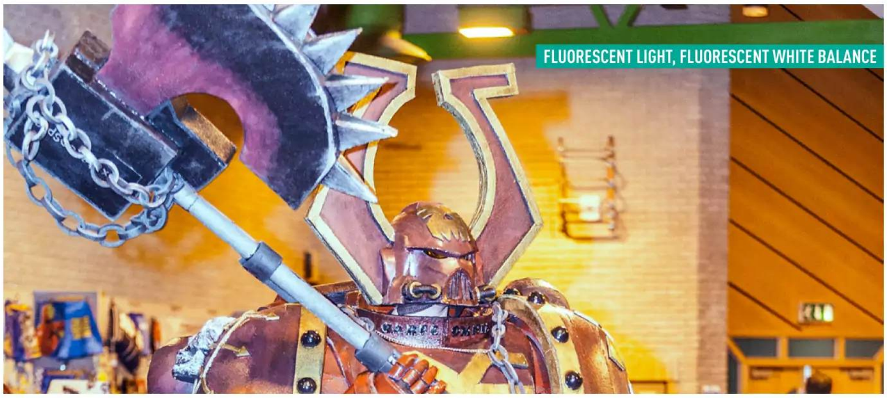
Manual white balance

Some cameras can let you calibrate the white balance setting manually. You simply hold a white card in front of the camera lens and press a white balance calibration button. The camera adjusts its white balance setting until the card is reproduced neutrally. Beware of this setting remaining on as when you return to normal shooting conditions it may spoil your pictures!

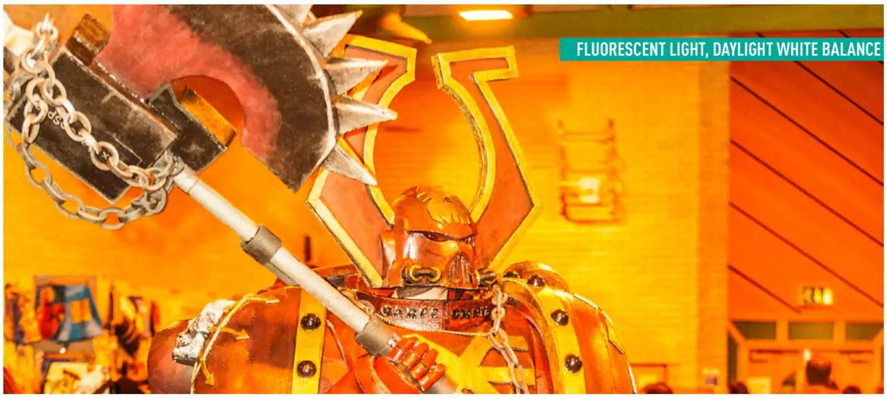
Preset white balance

All digital cameras offer a choice of white balance presets, and some cameras let you choose the setting via colour temperature values. Some really advanced cameras let you bracket white balance settings, or take a series of shots with settings above and below your standard setting. ■

> "We perceive various shades of white light illuminating a scene as neutral, a trick performed by our brains to maintain a sense of normality."



FLUORESCENT LIGHT, FLUORESCENT WHITE BALANCE



FLUORESCENT LIGHT, DAYLIGHT WHITE BALANCE

TYPICAL WHITE BALANCE VALUES

TUNGSTEN/ARTIFICIAL

2500-3000K

Indoor lighting using traditional non-fluorescent light bulbs.

FLUORESCENT

3500-5500K

Include strip lighting and modern compact fluorescent lamps

NORMAL DAYLIGHT

5500-6000K

Typical mid-morning to mid-afternoon conditions at sea level.

CLOUDY/OVERCAST

6000-8000K

Hazy or overcast conditions.

CLEAR BLUE SKY

10,000-15,000K

Exceptionally clear mid-summer or high altitude conditions, especially snow scenes.

TIPS FOR BETTER PHOTOS

Top tips that can help you take better photos

It is fairly common for us to rely on the automatic settings provided allowing us to simply point-and-shoot to take a photo. We feel that an automatic setting has its place but it does disconnect you from the actual process of taking a photograph. To be able to take your shots to the next level, you need to understand how to take control of your camera, see what makes a good shot and start taking the photos that you really want to capture.

There are a number of hints and tips we can pass on that can help you evolve as a photographer. Many of those tips cover shooting techniques, others may simply be advice about equipment and understanding a little more about your camera. You don't have to use them all but pick out a few that work for you, develop them and make them a part of your creative photographic process and they will stand you in good stead as you progress your skills. ■

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68 Buy a tripod
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68 Pick a prime
69 The holy trinity
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69 Depth cueing
69 Enhance your photos
69 Are you compensating?
69 Don't fear the histogram
70 Learn from others
70 Further afield
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1

Choose the right camera

When you're looking to buy a new camera for your photography, make a list of your requirements and set yourself a budget. Don't forget to allow for accessories such as lenses, a tripod and cleaning kit if you need them. Don't fall in to the trap of thinking that a more expensive camera will make you a better photographer. You're much more likely to improve your technique by overcoming the limitations of cheaper kit than by spending more money than you need to.

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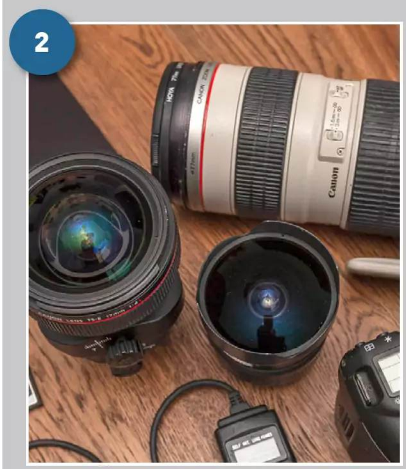

Choose the right lens

If you're buying a compact system camera or DSLR, it will probably come with a standard telephoto lens that is ideal for general photography and snapshots but there is a wide variety of special lenses available for other types of photography. If you like to shoot landscapes, get a good wide-zoom lens but avoid super-wide lenses as these will distort the image. If you want to shoot wildlife, you'll need a high quality fast telephoto but this will be expensive.

3

Buy a tripod

The quickest way to improve your photography is to invest in a decent tripod. For the best combination of strength, rigidity and portability, the ideal choice is carbon fibre. Carbon fibre tripods start at around £120 ($175, €165) and can cost ten times more, so if that's too expensive get a good quality aluminium one. Features to look for include a ratcheted centre column, portrait-format tilt and all-metal construction. Avoid ones with plastic heads, as they are seldom rigid enough to prevent camera shake on long exposures.

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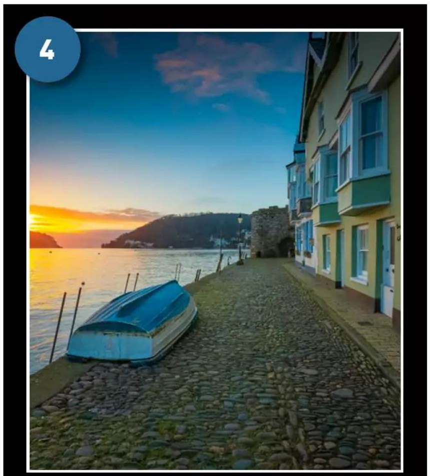

Early bird

Shooting a landscape in bright midday sun is fine but if you really want your shots to shine, you'll need to get up early and catch the light available just before the sun rises, and as it climbs above the horizon. The shadows are long, giving definition to objects and the light has that special golden ethereal quality. The same is true at the opposite end of the day, at sunset. The period of time around sunrise and sunset is called the golden hour. Simply switching the time you take photos can have a dramatic improvement on your shots.

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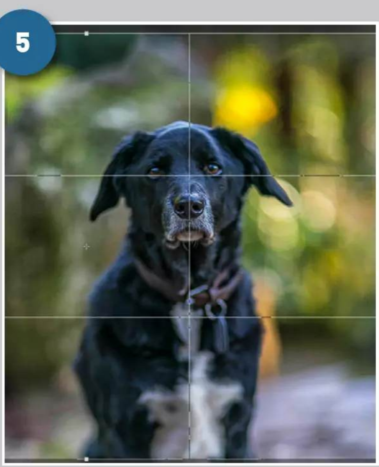


Visual interest

The rule of thirds is a simple guide that can help the composition of your shots and make them much more visually appealing. When framing a shot, you have to imagine that what you can see through the viewfinder of your camera is divided into thirds both vertically and horizontally with lines, just like a noughts and crosses game (or tic-tac-toe if you are in the US). Placing your main subject on an intersection where these lines meet is a simple and quick way to improve composition.

6

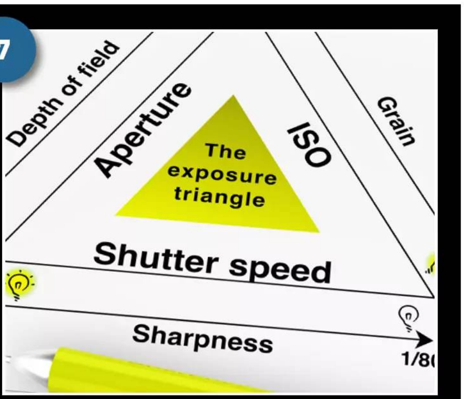
Pick a prime

Fast glass is much prized in the world of portraiture. Fast glass has very large apertures, letting in more light and offering faster shutter speeds in low-light conditions. A good portrait lens that has a maximum aperture of f/2.8 - f/1.2 is fantastic at creating the background blur so sought after by photographers. The quality of defocused light this blurring produces is referred to as bokeh. The ability to shoot at f/1.2, for instance, means you can shoot more natural light portraits, without the reliance on strobes.

7

The holy trinity

ISO, aperture and shutter speed are the three pillars of exposure. The main idea is that altering one of these three settings has an impact on exposure and therefore how your image looks. One or both of the other settings will have to be altered to maintain a balanced exposure. As you develop as a photographer, you will realise that once you are in control, you can create images that look more as you want, rather than what the camera thinks is right when in full auto mode.



8

Stop the shakes

Camera shake is the unwanted movement of the camera taking the shot and of the subject of the shot. Modern cameras offer image stabilisation and it can work well up to a point but the lower the light, the more the likelihood is that your shots will be blurry as you need longer shutter speeds to gather enough light for a balanced exposure. If you buy one thing to go with your new camera, make it a tripod. Use a robust tripod and your images will be rock steady in all manner of challenging shooting situations.

9

Depth cueing

A photograph only has two dimensions and any indication of depth in a photograph is purely optical. One of the simplest ways to add depth is to use leading lines like the curve of sand on a beach image or railway lines converging towards the horizon. Another method is atmospheric perspective where mist and fog shroud distant objects making them lighter and with less tonal contrast compared to darker foreground objects.

10

Enhance your photos

If your camera has the option to let you shoot Raw images, use it. A Raw image is the key to much greater post-processing possibilities. Raw images, as the name suggests, are just unprocessed raw data straight from the camera sensor with all the information you need to bring out a beautiful photograph. The act of cropping the shot into a more pleasing aspect ratio can save an image, as can turning it to black and white. The choices are endless, even if it's just contrast, saturation, brightness and sharpness.

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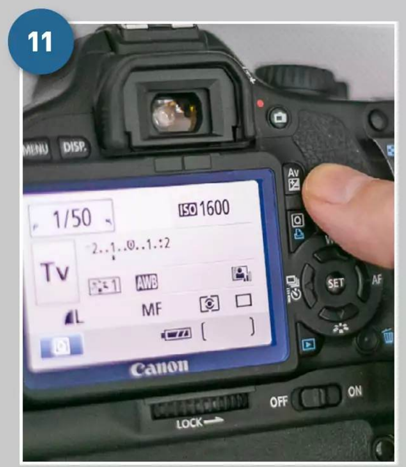

Are you compensating?

As good as cameras are, they will often overexpose and underexpose your photos in challenging lighting situations. That's where exposure compensation comes in. It's a common setting found on digital cameras and it lets you override the camera by making the image lighter or darker based on how much positive or negative exposure compensation you dial in. A lot of cameras will let you preview the result on your LCD screen and once you are happy with how it looks, you can take the shot.

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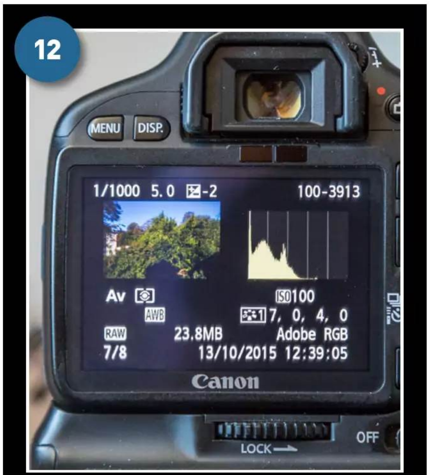

Don't fear the histogram

A histogram is a graphic representation of the tonal values in your photograph and how they are distributed. If the graph is bunched at the far left of the display, then your shot is very underexposed and you risk the loss of a lot of detail to shadow areas. If it is sliding off the right hand side, then it will be overexposed and detail will be lost in the highlight areas. A good exposure will have all the major tones in the middle of the histogram.

Learn from others

Even the best pros had to pick up a camera for the first time. There are any number of photography forums that you can join and then get advice from other photographers. Why not join a local photography club? It's a great way to meet fellow like-minded photographers of varying skill levels. It's is also a good way of getting motivated to get out and take more photos. You're also more likely to be able to chat with those who are well versed in using software to post-process their images.

13

14

Further afield

Find a lovely location that you want to photograph and research the area a little, then get yourself out there. Plan to arrive before dawn and get some amazing shots of the golden hour. Explore the area and experiment with composition and camera settings. In fact, just go crazy and enjoy the experience. That's the key to photography. It's there to be enjoyed. Don't worry about making mistakes; keep those shots and review them when you get home and figure out why they didn't work, it's all part of the process.

Out of the shadows

While a bright summer day may seem like the perfect time to take photos, at midday every scene will appear flat and featureless with shadows sitting directly beneath every object. The perfect weather for outdoor photography is a bright day with a few white clouds to help diffuse the light and take the edge off the shadows. The perfect time is around sunrise and sunset, with the low sun casting long shadows that will help accentuate the contours of the land.

15

16

Batteries

Your digital camera can't operate without power, so make sure you fully charge the battery before taking it out for the day. If you're going away for a holiday remember to take your battery charger and an adaptor for foreign mains sockets; and maybe consider investing in a spare battery or external battery pack in case you can't charge it for a while. There are also several devices available that can charge your battery using solar energy or from a hand cranked mini-generator.

A sense of perspective

An average human, taking a photograph, is viewing the world from their eye level of about 5 feet. Simply changing that viewing angle can radically alter the shot. As a simple rule of thumb, shoot from low down, shoot from high up. Getting above or below your subject alters how you present your subject and how they fit in the world that's around them. You can play with wide angle shots or telephoto shots. You have an amazing amount of choice. Anything to break away from the eye level world that we are used to.

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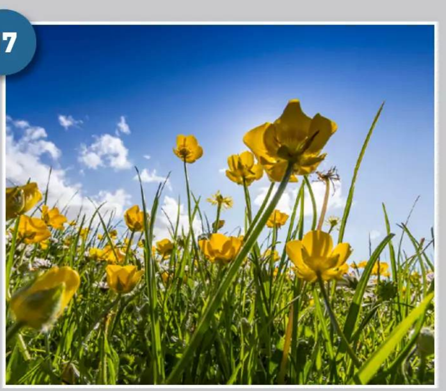

Maximum exposure

Consider using longer exposures in your landscape shots. Photographers often employ exposures that last seconds or even tens of seconds, to show clouds streaking across the sky rather than looking static and puffy. Scenes shot with a much longer exposure will turn the water to a misty, milky fog. It is safe to say that your tripod is the key to the success of these shots, as is a good set of ND filters to drive up those exposure times. Filters around the 4 - 8 stop range are perfect.

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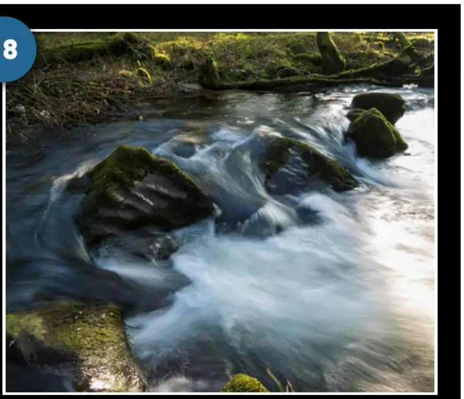

19

Whatever the weather

Remember that the weather is part of the landscape too. While a nice sunny day is perfect for outdoor photography, natural weather effects such as mist, clouds and even rain can be used to create an attractive photo under the right circumstances. Make the weather part of your composition. Try capturing mist in early morning light, or raindrops hitting puddles or the surface of a lake. Cloud formations can add a lot of interest to the composition of a panoramic landscape shot.

Night photography

You can capture amazing photos of the stars on a clear night by setting your camera on a tripod, setting the aperture to its widest position and using the 'B' exposure setting and a cable release to hold the shutter open for five or six minutes. Make sure you're well away from any light sources such as street lights or passing cars. If you point your camera towards the Pole Star (or the Southern Cross) you'll capture the apparent circular motion of the stars as the Earth rotates.

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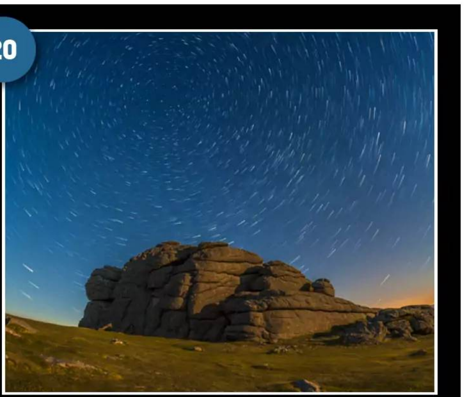

Low-light

When shooting in low light the most important thing to remember is that your camera's exposure meter will try to brighten everything up; this can cause problems with image noise at higher ISO settings. To capture dimly lit subjects against a dark night-time background, try reducing your exposure by a couple of stops. This will also help to reduce the blurring caused by camera shake and moving subjects during long exposures. Use a tripod if you have one.

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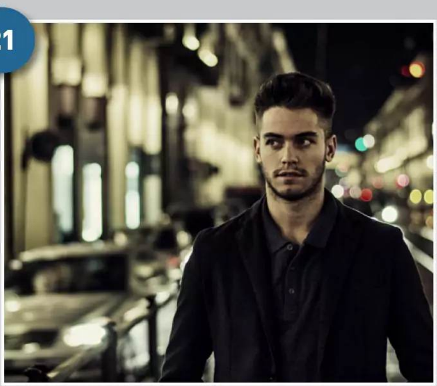

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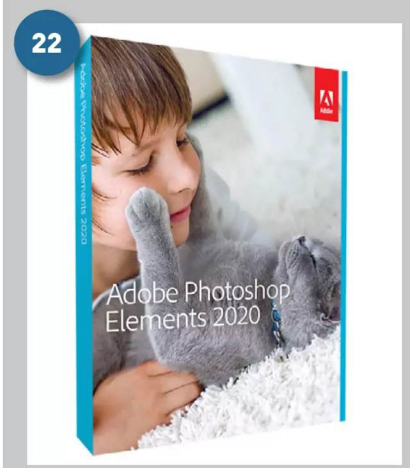

Photo editing software

To get the best out of your photos you'll need photo editing software. You can make simple edits with the Photos app that comes with Windows or with Photos on a Mac but for more accurate and detailed work you'll need something more capable. The best is Adobe Photoshop but with a monthly subscription fee, it may be too expensive for most hobby users. Fortunately, there are plenty of cheaper options, including Adobe Photoshop Elements 2020.

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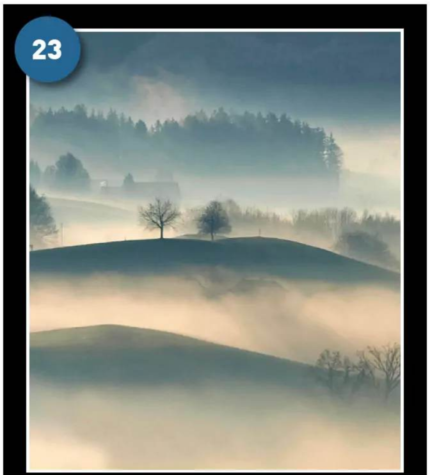

Cold conditions

Cold conditions can cause a few problems for your digital camera, the main one being its effect on batteries. You'll find that even on a cold morning after a clear summer night, your battery will only last around half as long. Make sure that you keep a spare battery in a warm inside pocket and swap them over when the first runs out. When you take your camera back indoors, keep it in a sealed plastic bag until it has warmed up. This can really help to avoid condensation problems.

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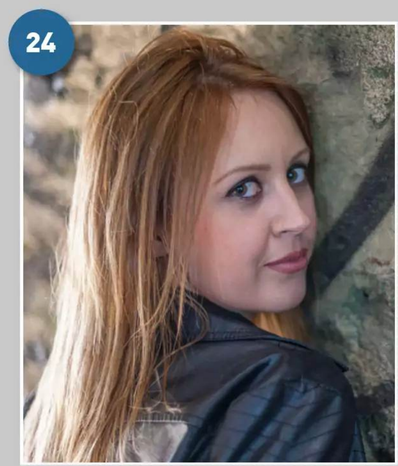


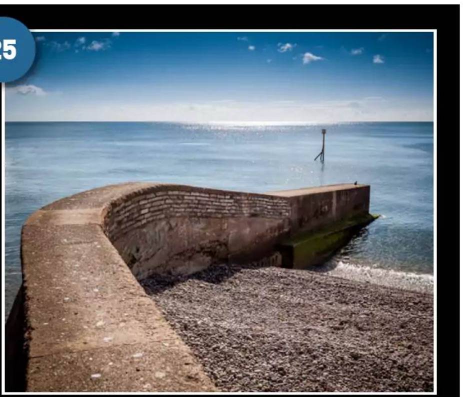
Natural light portrait

Have you thought about shooting your portraits outdoors to take advantage of natural light? Try positioning your subject so that their face is well-lit but don't believe the old tip about having the "sun over your shoulder". You should avoid having them face directly into the sun, because this will cause them to squint. The best option is to have them stand in bright shade, or near a white wall or other light coloured object that will reflect a flattering diffused light.

Leading lines

25

There are many rules and guidelines for photographic composition but one that applies most often to landscape photography is the concept of leading lines. When composing your shot, try to find lines in the scene, such as roads, rivers, railway lines or hedges. Frame your shot so that these lines will lead the viewer's eye into and through the scene. They will also help to give the scene a sense of scale and perspective and this will also help with your composition. It doesn't matter if they are straight or curved.



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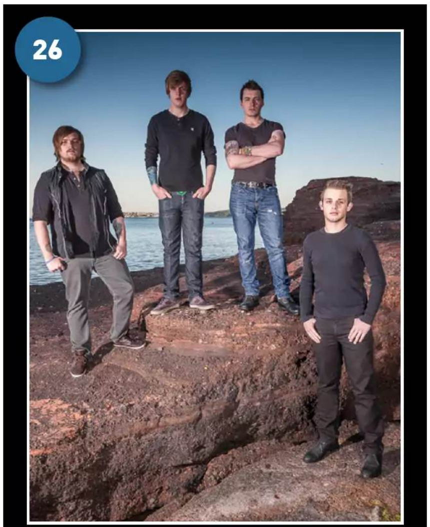


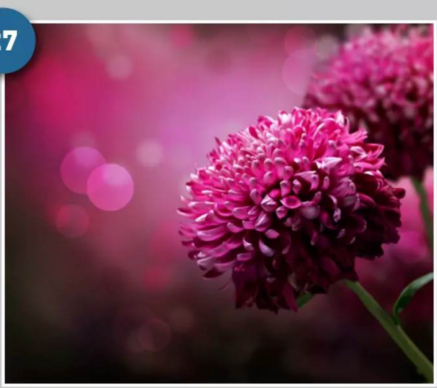
Group portraits

If you're shooting a group portrait, try to find a location that lets you position your subjects at different heights. A set of broad steps, a low wall, a park bench or even the trunk of a fallen tree make ideal impromptu stages, and add interest to what would otherwise be a fairly dull photo. Position shorter people at the front of the group or get those at the front to kneel, so that everyone can be seen clearly in the shot.

Depth of field

27

Depth of field is the distance between the nearest and most distant objects in a scene that are in focus and acceptably sharp. It is controlled by a combination of aperture and focal length and is an important creative tool for improving your photographs. Use a shallow depth of field (with a wide aperture) to isolate subjects against a blurred background, or use a large depth of field (narrow aperture) to capture an entire scene in sharp detail. Portrait photographers love shallow depth of field.



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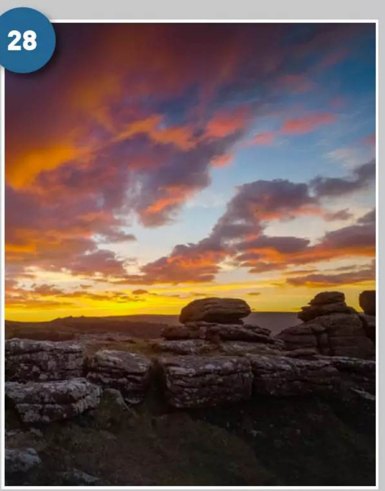


Time of day

When shooting landscape shots, the time of day is all-important. You can't control the position of the sun in the sky, so you'll have to wait for it to be in the right position to provide the best lighting for your scene. Make a note of sunset and sunrise times and try to visit the same location several times at different times of day. The favourite times for perfect lighting are an hour after sunrise and an hour before sunset, known as the 'golden hour'.

Position

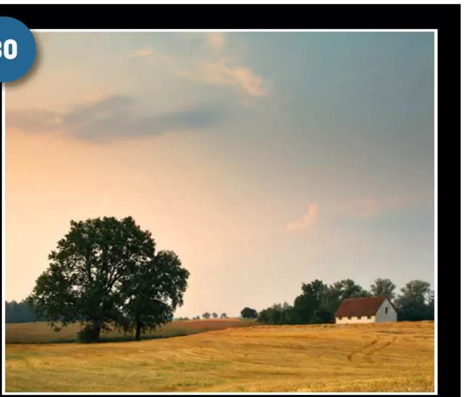
29

Since you can't move the landscape around to suit your composition, choosing the right position to take your shot is all-important. Study the scene you want to capture and try to picture how it would look from higher up, lower down or from a different angle. Be aware of obstructions such as power lines and pylons, and try to choose a location that minimises their impact. The perfect location may involve a bit of hiking but it will be worth it. Don't stay rooted to one spot; be prepared to move around a lot.

Harmony and balance

30

There's more to a good landscape composition than just a snapshot of some nice hills. Try to include foreground detail such as old walls, rock formations or plants. They will add depth and a sense of perspective and scale to your picture, and make for a much more interesting composition. Try to balance foreground detail with background detail to create a harmonious balance to your composition. Using the rule of thirds will help you greatly.



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Close-up

Good close-up photography requires either a camera with a very close minimum focusing distance or a special macro lens. The main problem with extreme macro photography is that the object you're focusing on will be in the shadow of your camera, so try to arrange lighting from the side. One handy gadget to try if you plan to do a lot of close-up work is a ring flash, which provides even illumination from all sides.

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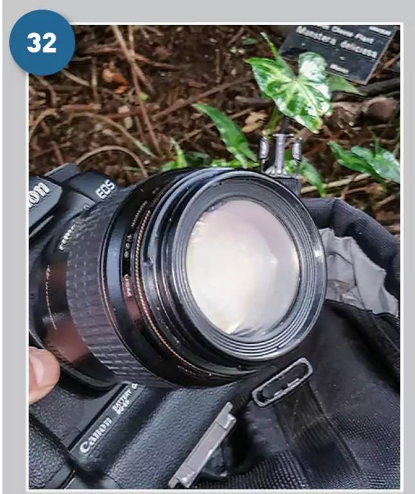

Hot weather

Hot weather can also cause some problems, with condensation and high humidity being at the top of the list. Keep a couple of bags of silica gel in your camera bag to absorb any stray moisture and wipe off any surface condensation as soon as it forms, to avoid it seeping inside your camera and messing up the electronics. Keep your lens clean too and avoid the problem of fungal blooms growing inside the lens barrel.

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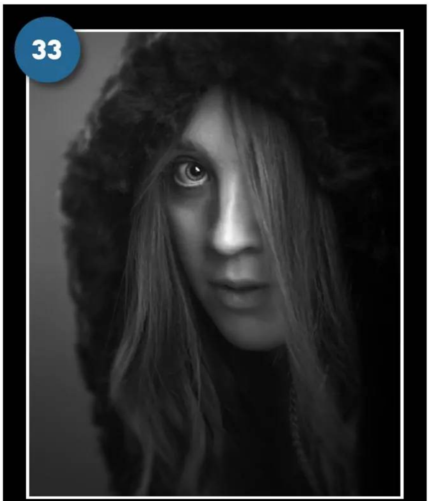


Black and white

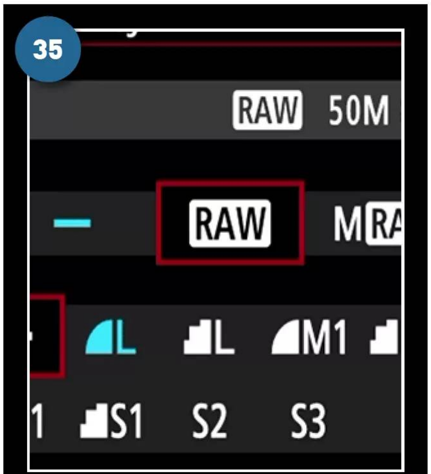
There are many subjects that can look great in black and white, particularly portraits, rough textures like old stone, and even landscape shots. However the black and white mode on your camera may not do the scene justice. You can get much more creative control over the final appearance of the image by converting the photo to monochrome using photo editing software. This is especially true if you shoot in Raw mode, with its much greater tonal range.

34

Focal length

Focal length, or the zoom setting of your lens, is one of your most important creative tools. Longer focal lengths let you get closer to distant subjects, whilst wide angle settings let you capture more of your surroundings. However, most people only ever seem to use the minimum and maximum settings. If you do this you're missing out on a lot of creative potential. Use focal length creatively to improve composition or to focus attention on details in a scene.

35



Raw mode

Most high-end cameras, and even some of the better mobile phone cameras, have a feature called Raw mode. This is the equivalent of the negative in a film camera; you can take the Raw image data and process it yourself using image editing software such as Photoshop. The advantage is that the Raw mode file contains uncompressed data with more colour information and tonal depth than the processed JPEG image that your camera usually produces, so you can do more with it.

36

Get on their level

Children, as you may have noticed, are usually considerably shorter than adults, so all too often when photographing them they're either looking awkwardly upwards into the camera or you can only see the tops of their heads. When photographing young children, try kneeling or sitting down, so that you're more or less on their level. You'll appear less intimidating and your picture will capture the world from the child's point of view.

Glossary

Some terms you may encounter, explained in more detail

AMOLED
Stands for active-matrix organic light-emitting diode. A new type of display technology used in mobile devices and televisions, used in the monitors of some digital cameras. Has several advantages over LCD, including using less power.

Aperture
Behind the lens of your camera is a movable circular iris which opens and closes to control the amount of light falling on the sensor. This is usually controlled by the light meter, although some cameras have a manual aperture control. Altering the aperture also changes the depth of field.

Aperture Priority
This is one of the semi-manual exposure options found on some cameras. The user sets the aperture according to the depth of field they require, and the metering system sets the shutter speed to obtain the correct exposure.

Artefacts
When an image is stored in your camera's memory it has to be compressed to fit, usually into a JPEG file, and in the process some information is inevitably lost. When the image is uncompressed for viewing, noise creeps in and appears as angular blocks in the image, which are known as artefacts.

Autofocus
Almost all digital cameras have automatic focusing. There are essentially two types; contrast detection, used in compact cameras and most CSCs, uses the camera's main sensor and works by detecting the borders between high-contrast areas and trying to make them as sharp as possible. Phase detection AF is used in digital SLRs and some CSCs, and uses a separate sensor. It is usually faster and works better in low light conditions.

AE Lock
Stands for Auto-Exposure Lock, a function found on most advanced digital cameras. This enables you to take a light meter reading from a particular part of the image and then hold that setting while you compose the image. Useful for dealing with back lighting and other difficult lighting situations.

Backlighting
Backlighting occurs when your subject is brightly lit from behind, such as somebody standing in front of a sunlit window. Unless you adjust the exposure to compensate for this, your subject will appear as a dark silhouette against the bright background.

Back-side illumination
Not to be confused with backlighting, this refers to a new method of sensor design. In conventional sensors the wires connecting the photocells of the sensor run over the front surface of the chip, reducing the light-collecting area. Back-side chips are made the other way up, so that the wires are on the back. Offers potentially better low-light performance.

Barrel distortion
Barrel distortion occurs when a wide angle lens distorts an image so that it appears slightly spherical. If you take a seascape with a wide-angle setting and notice that the horizon seems to curve, this is barrel distortion. It's most noticeable when there are straight lines near the edge of the frame. In digital images barrel distortion can be corrected in image-editing software.

Bracketing
Bracketing shots is where a photographer takes the same shot three times or more, each at different exposures. This increases the chance of getting an ideally exposed image. Also, it's possible to combine the shots in software to increase the light and shade within the image, which is essentially how HDR works.

Burst mode
Many cameras offer a burst mode, which means they can take several images in rapid succession, just as you'd get with a motor-wind on a traditional film camera. The number of shots that can be taken is limited by the speed of the camera's image capture and processing systems, as well as the size of the internal memory buffer. You'll typically get about three frames per second from a standard digital camera in burst mode.

Centre-weighted metering
This is when the camera takes an average light reading from the whole frame, but pays more attention to the centre of the image where the subject normally is. This has been largely superseded by multi-pattern metering, which is better able to cope with unusual situations.

CCD
Stands for Charge Coupled Device. This is the light sensor behind the lens of your camera that records the image when you take a photograph. It consists of a grid of millions of tiny light sensors, one for each pixel of the image. The size of a CCD is measured in megapixels, and the higher the megapixel rating, the better the image quality.

Chromatic aberration
Coloured fringes that appear around objects, often toward the edges of the frame. Caused by light rays of different wavelengths coming to focus at different distances from the lens. Better quality lenses seek to minimise this by the use of special coatings and lens designs. Can be corrected by software after the picture is taken.

CMOS
Stands for Complimentary Metal-Oxide Semiconductor. A chip-manufacturing technology used to produce the sensors in an increasingly large proportion of digital cameras. Cheaper but with better tolerance than other methods.

Depth of field
When you focus your camera on a subject, some detail behind and in front of the chosen subject will also be in focus. The distance between the nearest and furthest in-focus objects is known as the depth of field. It is changed by altering the size of the aperture – the smaller the aperture, the larger the depth of field.

Digital zoom
Some cameras give you the option of zooming in on the centre part of an image by expanding it in the camera. Although the zoomed area looks bigger, it still contains the same number of pixels as it did originally, so it will appear blocky and will lack resolution. This is not to be confused with optical zoom, which is far superior.

Dynamic range
The difference between the lightest and darkest areas of an image. If a camera can simultaneously capture shadow and highlight detail then it has good dynamic range. Few cameras can do both but they are improving all the time.

DPI
Stands for Dots Per Inch. The sharpness of an image produced by a printer is defined by how many dots of ink per inch of printed paper its print head can produce. A figure of 1,200dpi or higher is usually required for high quality results, although most modern printers are capable of this.

Effective pixels
Although your digital camera may claim to have 13.6 million pixels on its CCD, some of that number will not be used for taking the picture. Usually, some pixels around the edge of the sensor are painted black to provide a colour balance, while others fall outside the range of the lens.

Electronic viewfinder
Some cameras have a viewfinder containing a miniature LCD monitor showing you what the camera sees. This usually uses less battery power than the LCD screen on the back of the camera, but can be a strain on the eye and difficult to focus.

Exposure
When you take a picture, the camera determines how long the shutter should be open for and how wide the aperture should be, thus obtaining the correct exposure. If a picture is too dark, it is underexposed, whereas if it goes the other way and is too light, it is then referred to as being overexposed.

External flash
This means that the camera has a connection, usually a hot-shoe, that enables you to use a flashgun other than the one built into the camera. This allows a lot more creative freedom and control over lighting, because the flash can be positioned further away from the camera. This feature is only usually available on more expensive or professional-quality cameras.

EXIF
The Exchangeable Image File (EXIF) format is used by nearly all digital cameras that output pictures as JPEGs. It enables information, such as the GPS co-ordinates, date and time the shot was taken, plus exposure and other camera information, to be stored in the image file alongside the normal picture information.

Fixed focus
Cheaper cameras have fixed-focus lenses, which means they cannot be adjusted. Instead they rely on a very narrow aperture to make everything appear in focus, from a few feet in front of the camera out to infinity. They are fine for snapshots at average distance in good light, but are not so good for creative photographs where focus can be used to produce unusual effects.

Focal length
In brief, this term describes the magnifying power of the camera's lens. The longer the focal length, the greater the magnification. Conversely, the smaller the focal length, the more wide-angle the lens. Most digital camera zoom lenses can vary between short and long focal lengths.

f-number
This is the number which describes the ratio of the aperture of a camera's lens to its focal length. Generally, a higher quality lens will have a smaller f-number, which bizarrely means a wider maximum aperture, and thus more light entering the lens.

HDR
A rather over-used technique whereby several shots at different exposures are combined to produce one image capturing a very wide range of contrast, or dynamic range. Useful for high-contrast lighting and night-time shots, but can be over-used by art students who've just discovered it.

Histogram
A histogram is a graph of brightness. It ranges from black through grey to white along the horizontal axis, while values in the vertical axis represent the number of pixels at the appropriate brightness. It provides a means of checking the exposure of an image. If too many pixels are present at the left-hand side of the histogram, the image is underexposed, while if it's weighted to the right, then it's likely to be overexposed.

Interpolation
Some cameras and image-editing software can increase the size of a digital image by adding extra pixels in between the original ones. They take an

average of the pixels around the new one and attempt to match the colour and brightness to create a seamless image. Some systems give better results than others.

ISO
Stands for International Standards Organisation. In conventional photography, the ISO number is a measure of the light sensitivity of photographic film, and this has been carried over into digital photography as a way of expressing the light sensitivity of the CCD.

Jaggies
'Jaggies' refers to jagged diagonal lines that appear in a low-resolution picture. Pixels are square, so if large pixels are being used to represent a diagonal, you'll be able to see the corners of each, creating a saw-like edge. Anti-aliasing is used to soften jaggies, whereby the software will attempt to calculate 'in-between' shades to blur the line a little and make it look a lot smoother.

JPEG
This file type stands for Joint Photographic Expert Group, and is the most commonly used system of image compression. Using a sliding scale between file size and picture quality, it enables digital cameras and computers to squash a large picture into a small amount of memory. Be careful when compressing files, though, because too much compression will reduce the quality of your image.

Landscape mode
A program exposure option found on many mid-priced cameras, this function automatically selects the best exposure settings for taking landscape photographs, usually a longer shutter speed and the narrowest possible aperture to maximise depth of field. It can also refer to holding the camera horizontally, which is usually preferred for landscape shots.

LCD
Stands for Liquid Crystal Diode, a display technology first developed in the 1970s, and in widespread use today. Most cameras have an LCD monitor screen mounted on the back for viewing photographs. Some also have an LCD electronic viewfinder, and some DSLRs also have a separate LCD data display panel.

L-ion
Stands for Lithium Ion. This is the latest kind of rechargeable battery, superior even to Ni-MH. It can hold more power, and does not suffer from 'memory effect', where a partially charged battery, when recharged, will only register the additional charge rather than its full capacity.

Macro mode
This traditionally refers to a lens that can focus closer than its designated focal length, but these days it is used to describe any facility for taking extreme close-ups.

Manual mode
This is for experienced photographers only. It gives you full control over both aperture and shutter speed, enabling you to experiment with exposure and depth of field. Essential for any creative photography.

Megapixel
Megapixels are a measure of the size and resolution of the pictures that a digital camera can produce. Mega means one million, and in this case a million pixels, or more accurately a million individual light sensors on the camera's CCD. The more megapixels, the better.

Memory card
Most digital cameras store your pictures on removable cards full of computer memory. They come in a variety of sizes and there are several different types, including CompactFlash, SD and MicroSD cards as well as Sony's own Memory Stick format.

Metering system
This is how the camera measures the amount of light being reflected by whatever you are trying to photograph, to determine the correct exposure for that particular scene. There are many different types, including spot metering, multi-pattern metering and centre-weighted metering.

Multi-pattern metering
This is a sophisticated means of determining the correct exposure of a photograph. The camera takes light readings from several different areas of the frame and compares them to its pre-programmed data to determine the right exposure. The idea behind this is that bright light sources, such as the sun or brightly lit windows, won't cause the rest of the image to be underexposed.

Night-time mode
A program exposure mode that compensates for low light by setting the aperture to maximum. This lets the most available light into the camera and gives the fastest possible shutter speed under the circumstances.

Ni-MH
Stands for Nickel-Metal Hydride, a type of rechargeable battery rapidly replacing older Nickel Cadmium (NiCad) batteries. Ni-MH batteries do not suffer from the 'memory effect' which was a problem with older rechargeables, and they can also store a lot more power. This makes them ideal for use in battery-guzzling digital cameras.

Optical zoom
With recent advances in lens manufacturing technology, many digital cameras now have small but powerful optical zoom lenses. This means they can be adjusted to magnify the image (zoom in) or to capture a wide-angle shot (zoom out). Because the image uses the full capabilities of the CCD this is preferable to digital zoom.

Pixel
Short for Picture Element. If you enlarge a picture on your computer, you will see that it is made up of tiny squares of a particular colour and brightness called pixels. A pixel is the basic building block of a digital photograph, and there can be several millions of them in an image. The higher the pixel count, the better the quality of the photograph.

Portrait mode
This is a program exposure mode that optimises the camera for taking classical portrait shots, widening the aperture to minimise the depth of field. This ensures that only the subject is in focus, while the shutter speed is increased to minimise camera shake.

Processor
All digital cameras have an image processor, which takes the data from the sensor and turns it into the finished JPEG image that you see on the screen. A faster processor means larger resolution images can be processed more quickly, improving the camera's performance.

Program exposure
Found on most digital cameras, program exposure is an automatic setting where the camera's metering system selects an appropriate aperture setting and shutter speed in an attempt to get the best exposure and performance out of the lens.

RAW
RAW mode is found on most high-end digital cameras. It is an option which stores the uncompressed raw data from the sensor, which can then be processed on a computer using software such as Adobe Camera Raw, Bibble etc. Raw files contain more information than JPEGs, and take up more memory. Raw is actually not an acronym and so shouldn't be all capitals; it should really be written simply as "raw".

Resolution
The more pixels there are in an image, the sharper that image will be. This is the resolution of the picture, and is usually expressed as two numbers representing the height and width of the image in pixels, such as 3,872 x 2,592. Multiplying these two figures gives you the effective megapixels, in this case 10.03MP.

Shutter
The shutter is a device behind the lens of the camera which is normally closed, but opens for an instant when a picture is taken to allow light into the camera and onto the CCD. The length of time the shutter is open for is determined by the metering system, and is known as the shutter speed.

Shutter lag
This is a problem found on many digital cameras. Because of the way they work, there will often be a slight delay between pressing the button and the camera actually taking the photograph. The latest camera designs have reduced this problem a great deal, so check this when buying a new camera.

Shutter Priority
This is a semi-manual mode that enables the photographer to specify a shutter speed while the camera's metering system sets the aperture for the correct exposure.

SLR
Stands for Single-Lens Reflex. A mirror or prism reflects the light coming in through the lens to the viewfinder, so when you look through it you see exactly what the camera sees.

Spot metering
Found on the more expensive cameras, this metering mode enables the photographer to take a light reading from a small area in the middle of the frame, usually marked in the viewfinder. This is the best way of dealing with difficult lighting conditions such as backlighting, and is normally used in conjunction with auto-exposure lock.

Time lapse
We've all seen films of flowers opening at incredible speed, or the sun and clouds racing across the sky. This super-fast motion technique is called time-lapse photography, whereby a stationary camera takes several successive shots at time intervals of a few seconds, minutes or even hours. The images are then played back rapidly, giving the impression of continuous motion.

VGA
Stands for Video Graphics Array, and refers to an image size of 640 x 480 pixels. This was once the standard size of a computer monitor output, but these days even mobile phones have larger displays. VGA is still sometimes found as an image size mode, particularly in the video recording modes of some cheaper cameras.

White balance
Most modern digital cameras automatically adjust the colour balance of the picture to compensate for any tints in the ambient light, such as sunlight, fluorescent strip lights or normal light bulbs. This is called a white balance, and means you can take a picture indoors without that orange tint you get with a film camera.

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